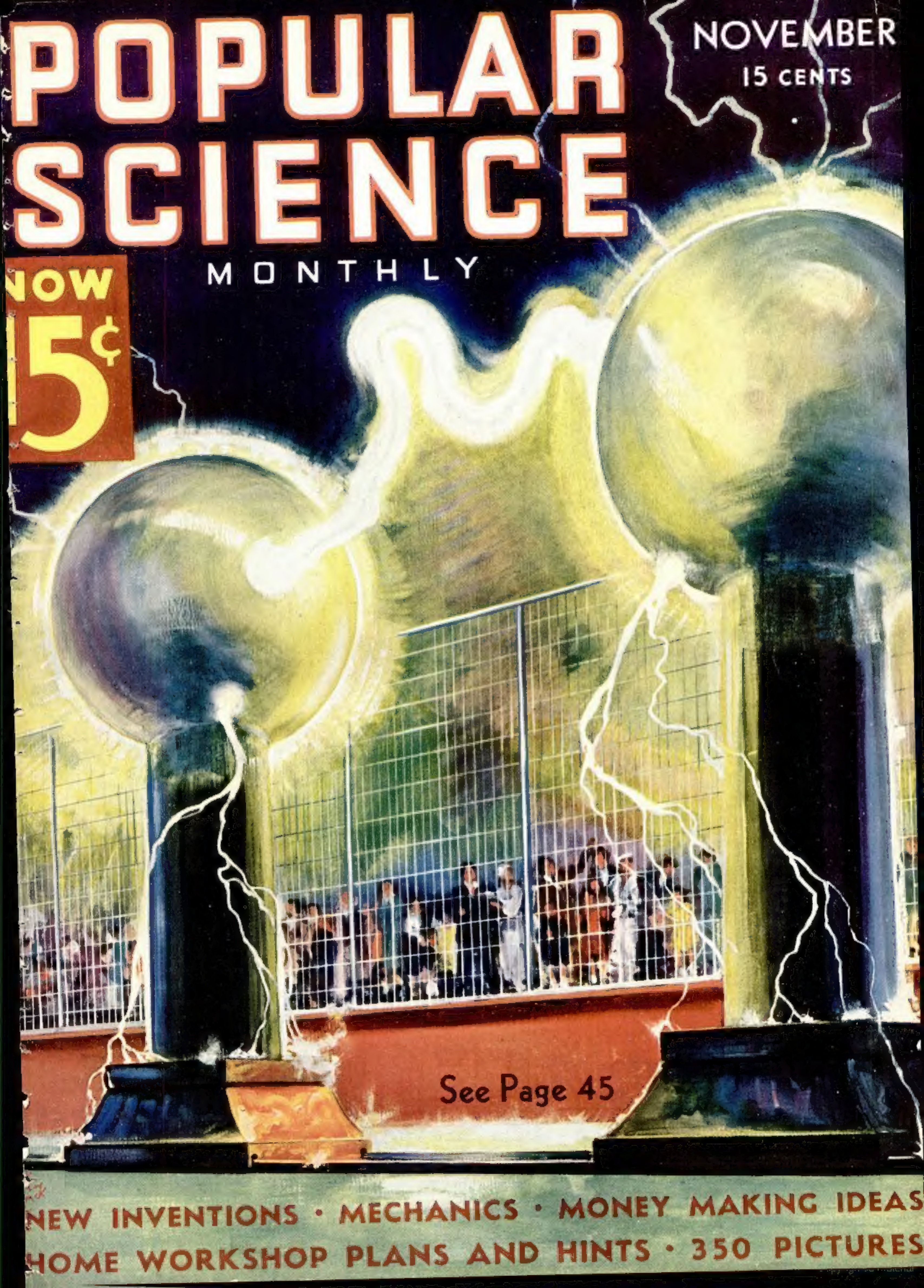


POPULAR SCIENCE

NOVEMBER
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MONTHLY



See Page 45

NEW INVENTIONS • MECHANICS • MONEY MAKING IDEAS
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STRANGE BUT TRUE



540,000

AUTOMOBILES FROZE UP LAST WINTER

(OFFICIAL STATISTICS)

THOUSANDS OF THESE CARS FROZE UP AFTER THEIR OWNERS HAD PUT IN ALCOHOL ANTI-FREEZE. THIS WAS POSSIBLE BECAUSE ALCOHOL, OR ANTI-FREEZE BASED ON ALCOHOL, BOILED AWAY WHEN THE WEATHER TURNED WARM BETWEEN COLD SNAPS



THERE ARE
APPROXIMATELY
50 BRANDS
OF ANTI-FREEZE ON THE
MARKET WITH AN
ALCOHOL BASE,
BUT CALLED
SOMETHING ELSE!

ANTI-FREEZES OF THIS CLASS MUST BE CHECKED FREQUENTLY FOR BOIL-AWAY, AND MORE ADDED FROM TIME TO TIME, TO AVOID DANGER OF COSTLY FREEZE-UP

**EVEREADY
PRESTONE**
PUT IN YOUR CAR ONCE
PROTECTS IT AGAINST
BOTH FREEZE-UP AND
RUST
ALL WINTER LONG




THOUSANDS, DISAPPOINTED BY OTHER ANTI-FREEZES BOUGHT EVEREADY PRESTONE AFTER JANUARY FIRST LAST SEASON, THEY WILL SAVE MONEY THIS SEASON BY BUYING EVEREADY PRESTONE BEFORE COLD WEATHER COMES **AND SO WILL YOU!**

GUARANTEED-CONTAINS NO ALCOHOL-AND ONLY \$2.70 A GALLON.

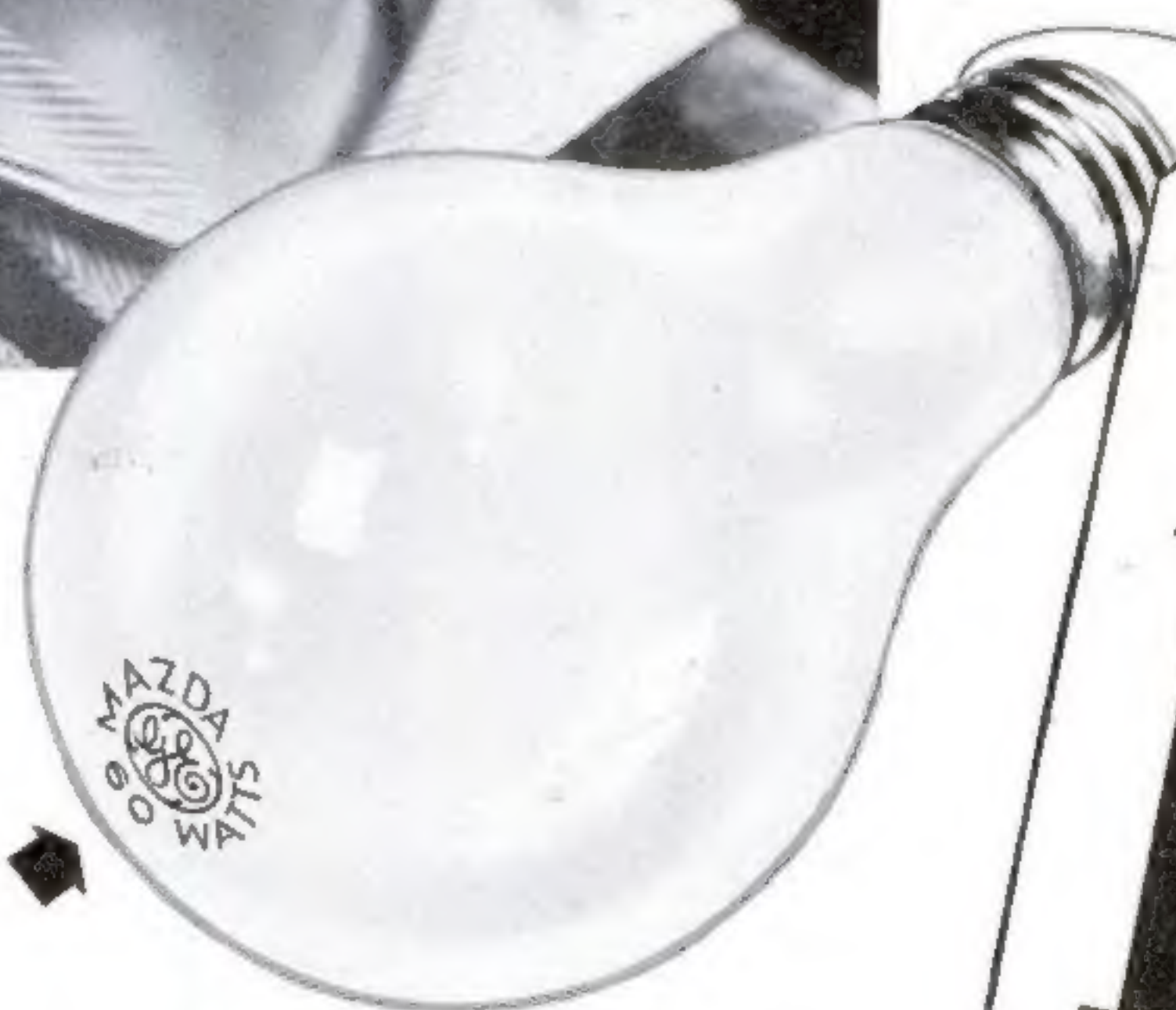
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Mom's wise now!

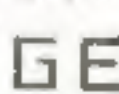


Mom used to tell me to bring home some 60-watt bulbs. Now she always says, "Be sure to get 60-watt General Electric MAZDA lamps." She's wise now! She has learned that good lamps like these STAY BRIGHTER LONGER and don't waste electricity. So now when I go to the store for lamp bulbs, I always look for the trademark  on the end of each bulb.

THEY
STAY BRIGHTER
LONGER *than*
inferior bulbs



GENERAL  ELECTRIC
MAZDA LAMPS

General Electric makes a 10 cent lamp, too!
It is the best lamp you can buy at the price.
7½, 15, 30 and 60-watt sizes. Each dime
lamp is marked like this 

NOVEMBER, 1936

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POPULAR SCIENCE

FOUNDED MONTHLY 1873

VOLUME 129 · NUMBER 5
15 Cents a Copy · \$1.50 a Year
Published Monthly by
Popular Science Publishing Co., Inc.,
353 Fourth Ave., New York

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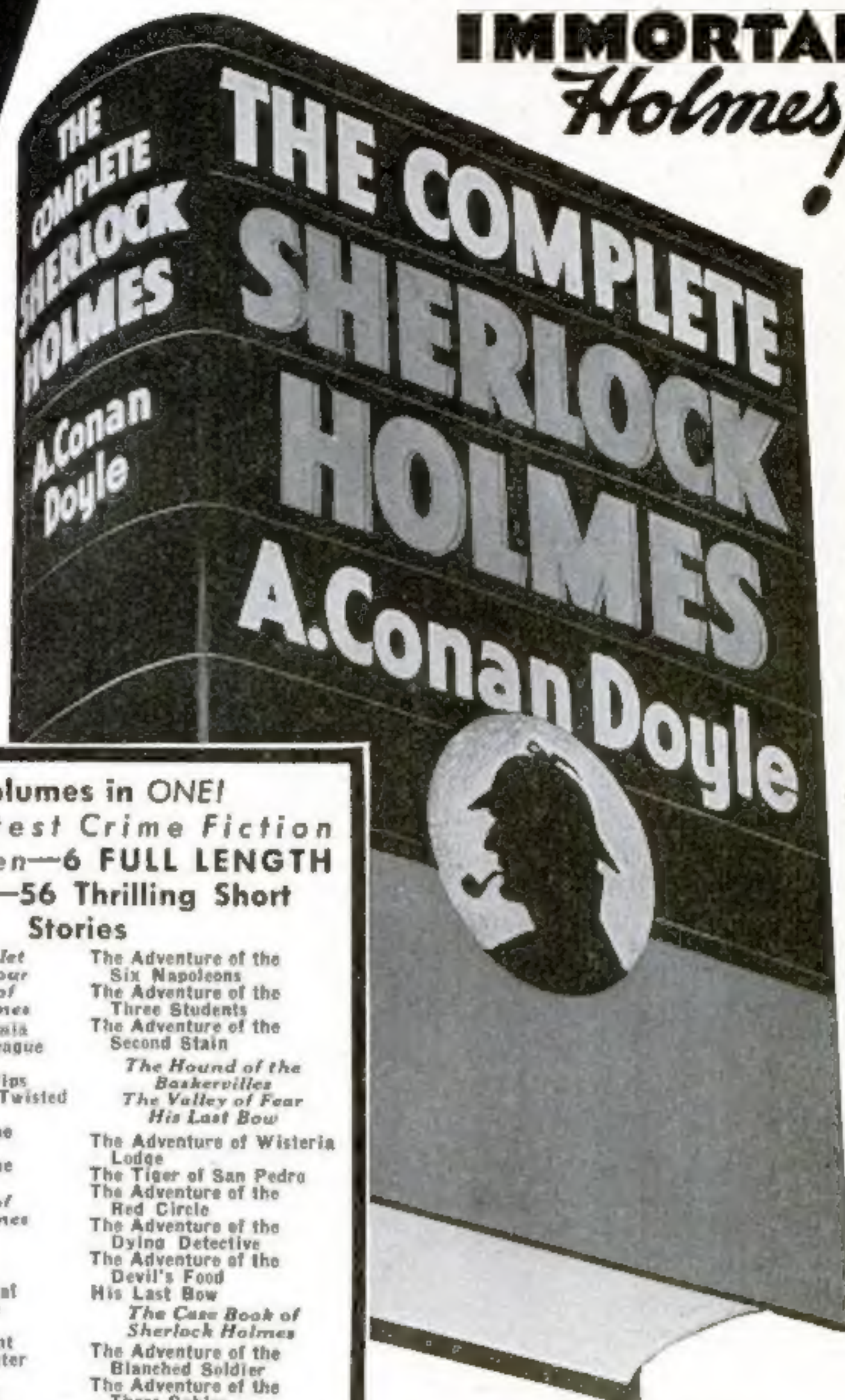
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"Just 30 minutes AND MY LUNCHEON'S ALL ARRANGED"

"I telephoned four girls, two stores and the florist in about thirty minutes. There's my luncheon arranged and off my mind."

The telephone puts the world at your finger-tips. It is a quick, dependable messenger in time of need—a willing helper in scores of household duties.

In office and home, these oft-repeated words reveal its value —"I don't know what I'd do without the telephone."

A telephone extension upstairs, beside the bed, is a great convenience at small cost. Saves steps and time—insures privacy.



BELL TELEPHONE SYSTEM



All New Cars Need SIMONIZ



The Sooner You Simoniz Your Car, the Better

No matter what car you have or buy, it should be Simonized. As experience proves, the sun, weather and dirt quickly dull the lustre—soon ruin the finish itself. Simoniz stops this destruction. The weather-proof protection which it gives makes any finish last longer. So, Simoniz your car now! If it's dull, first use Simoniz Kleener to quickly and easily restore sparkling beauty. Remember, nothing else is like Simoniz and Simoniz Kleener.

Always insist on them!



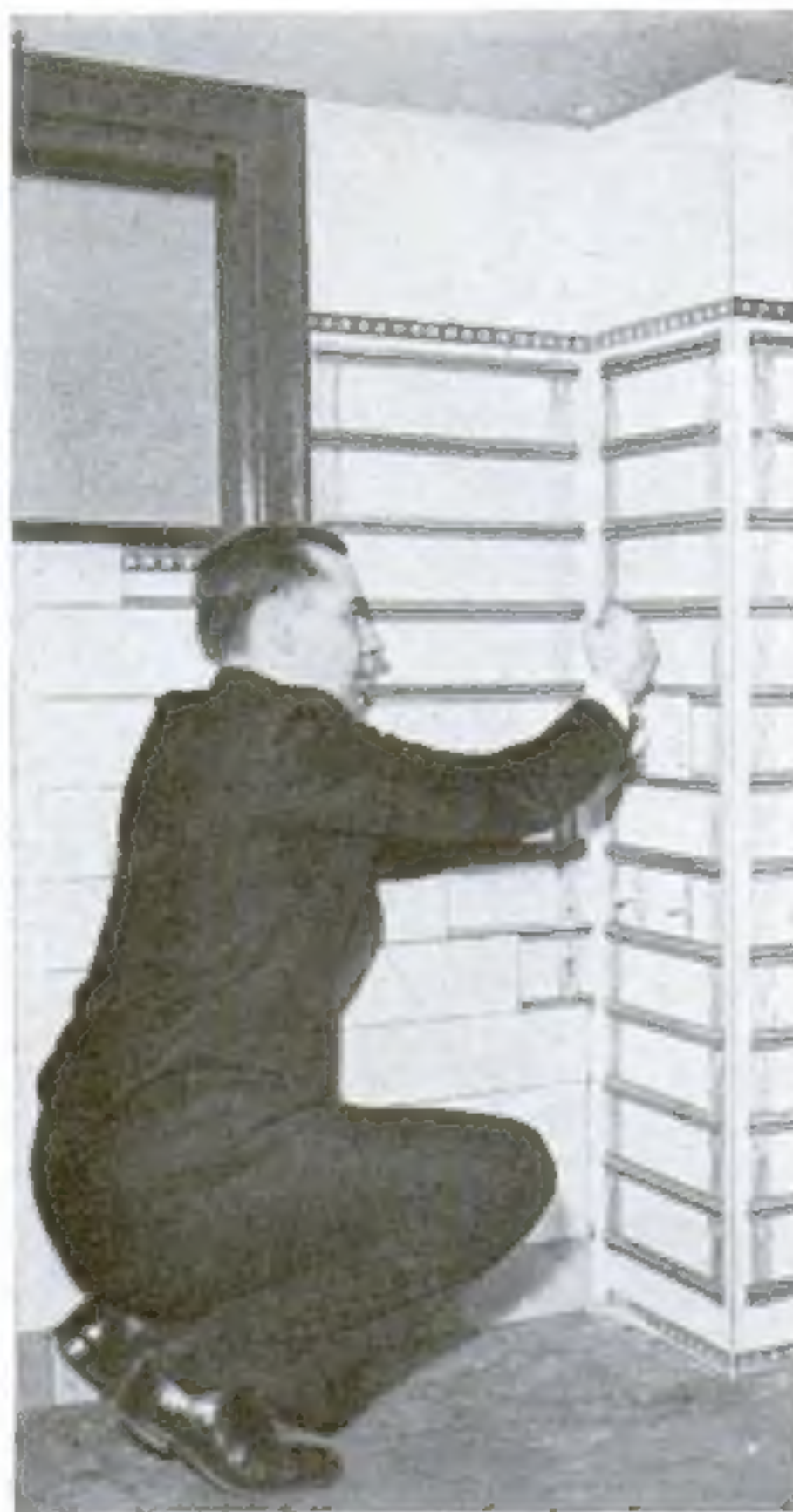
Motorists Wise

SIMONIZ

Rows of black dots on the surface of this new-type wall board simplify the problem of locating the wall studs and spacing the mounting nails evenly

Handy Aids

for Home Owners



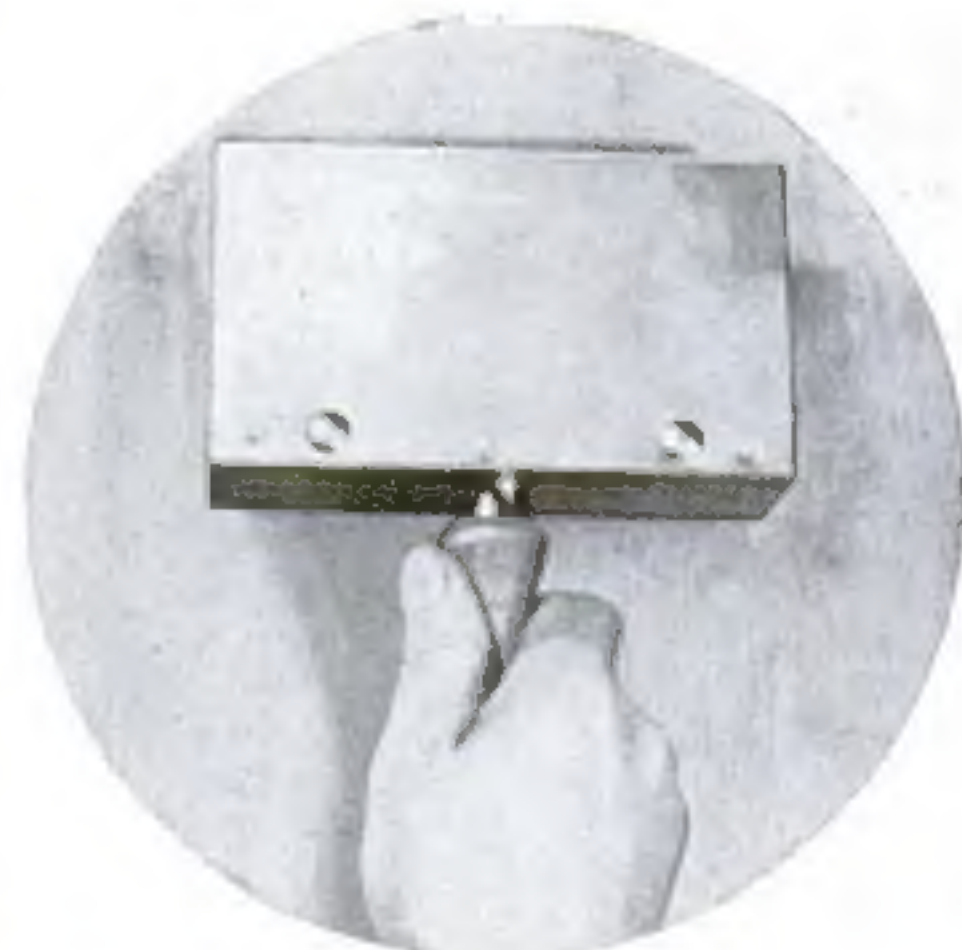
METAL MOUNTING FRAMES SIMPLIFY TILE LAYING

BY MEANS of special metal mounting frames now on the market, tile walls and floors can be assembled easily and quickly without the need of plaster or cement. Consisting of horizontal and vertical strips of thin metal, the frames are simply fastened to the wall or floor with screws and the tiles slipped into place. Although the tiles lock automatically, they can be removed easily, should it become necessary to replace broken units or make repairs to concealed plumbing or wiring. A sure grip on the tiles is provided by the metal holders, eliminating the chances of a poor plaster bond and falling tiles.

DOTTED lines printed on the surface of a new wall board serve as convenient guides for placing the mounting nails. Each panel is provided with three vertical rows of dots—the two outer rows indicating where the nails should be placed when the wall studs are sixteen inches between centers and the center row providing a guide for studs placed twenty-four inches apart. Since the dots in each row are spaced three and one half inches apart, they also serve as a guide for the vertical spacing of the nails. This arrangement saves time and prevents a waste of the building material.

HANDY WALL SCRAPER REMOVES OLD CALCIMINE

EVEN the thickest and oldest calcimine finish can be removed easily from plaster or board walls with the handy scraper illustrated below. Pressed against the dampened wall and pushed up, a built-in scraper peels off the calcimine coating and deposits the shavings in the rectangular metal container that forms the main body of the tool. Wing nuts hold the scraper blade in place, allowing easy removal for cleaning and adjusting.



New finish remover in use. Calcimine scraped from the wall drops into the metal container

Questions

FROM HOME OWNERS

Q.—I ALWAYS have trouble keeping a good coke fire. Can you give me any suggestions?
—D. L. K., Lansing, Mich.

A.—To GET the best results from coke, it is best to keep a lot of fuel under a low fire rather than a little fuel under a strong fire. Coke burns best with less draft than coal, so keep the ash-pit damper closed and the chimney draft only partly open.

RUSTPROOFING GARDEN TOOLS

G. B. S., PHILLIPSBURG, N. J. Whitewash, made with either salt or casein, will keep tools from rusting when they are left exposed to the weather or stored in the cellar or tool house for the winter.

BRIGHTENING UP BRICK WALLS

Q.—IS THERE any homemade preparation that I can use to brighten up brick walls that have become shabby?—G. V. G., Cincinnati, O.

A.—A SOLUTION consisting of one ounce of glue and a gallon of hot water, to which has been added a piece of alum the size of a hen's egg, one half pound of Venetian red, and one pound of Spanish brown, will restore the color of the bricks when brushed over the wall.

PROTECTING FRUIT TREES

B. W. P., ST. JOSEPH, MO. To keep rabbits from girdling your fruit trees when snow is on the ground, paint the trunks with a preparation made by melting five parts of resin and adding one part of beeswax and a half part of linseed oil. To this, add one half part strychnine and a half part lampblack. When ready to use, warm the mixture so it will spread easily.

CLEANER FOR LEATHER

N. O., EL PASO, TEX. Leather chair seats can be cleaned by thoroughly beating the whites of three eggs and rubbing them into the leather with a soft flannel cloth.

EASILY MADE WEATHERSTRIPPING

L. M. C., SPOKANE, WASH. You can make your own weatherstripping for small jobs by wrapping small strips of wood, about a quarter inch thick, with thin bands of woolen cloth. If the cracks are small, the woolen cloth can be used alone.

STORAGE RACK FOR SCREENS

S. B., CHICAGO, ILL. A good way to store screens so that they will not warp or rot is to build a rack a few inches off the cellar floor that will allow the screens to be stacked on edge and covered with a tarpaulin.

PORCELAIN PATCHING CEMENT

Q.—DO YOU know of any easily made cement or paint that I can use to patch chipped places in a bath tub?—P. C., South Bend, Ind.

A.—WHITE KEG lead added to a mixture of one part boiled linseed oil and seven parts hard-drying, durable varnish, will give a glossy, long-wearing finish.

FURNACE-INSULATION REPAIRS

G. B. C., BALTIMORE, MD. Defects in the insulating covering on your furnace should be patched with prepared asbestos cement, obtainable at most hardware stores. Requiring only the addition of water, it is applied with a trowel. When the cement has hardened, the entire surface should be refinished with a coat of white water paint or calcimine.

How a Man of 40 Can Retire in 15 Years



IT makes no difference if your carefully laid plans for saving have been upset during the past few years. It makes no difference if you are worth half as much today as you were then. Now, by following a simple, definite Retirement Income

Plan, you can arrange to quit work forever fifteen years from today with a monthly income guaranteed you for life. Not only that, but if you should die before that time, we would pay your wife a monthly income as long as she lives.

\$250 a Month beginning at age 55

Suppose you decide that you want to be able to retire on \$250 a month beginning at age 55. Here is what you can get:

1 A check for \$250 when you reach 55 and a check for \$250 every month thereafter as long as you live.

This important benefit is available alone; but if you are insurable, your Plan can also include:

2 A life income for your wife if you die before retirement age.

3 A monthly disability income for yourself if, before age 55, total disability stops your earning power for 6 months or more.

It sounds too good to be true. But it is true. There are no "catches" in it, for the Plan is guaranteed by a reliable, old company with over half a billion dollars of insurance in force. If you want to retire some day, and are willing to lay aside a portion of your income every month, you can have

freedom from money worries. You can have all the joys of recreation or travel when the time comes at which every man wants them most.

The Plan is not limited to men of 40. You may be older or younger. The income is not limited to \$250 a month. It can be more or less. And you can retire at any of the following ages that you wish: 55, 60, 65, or 70.

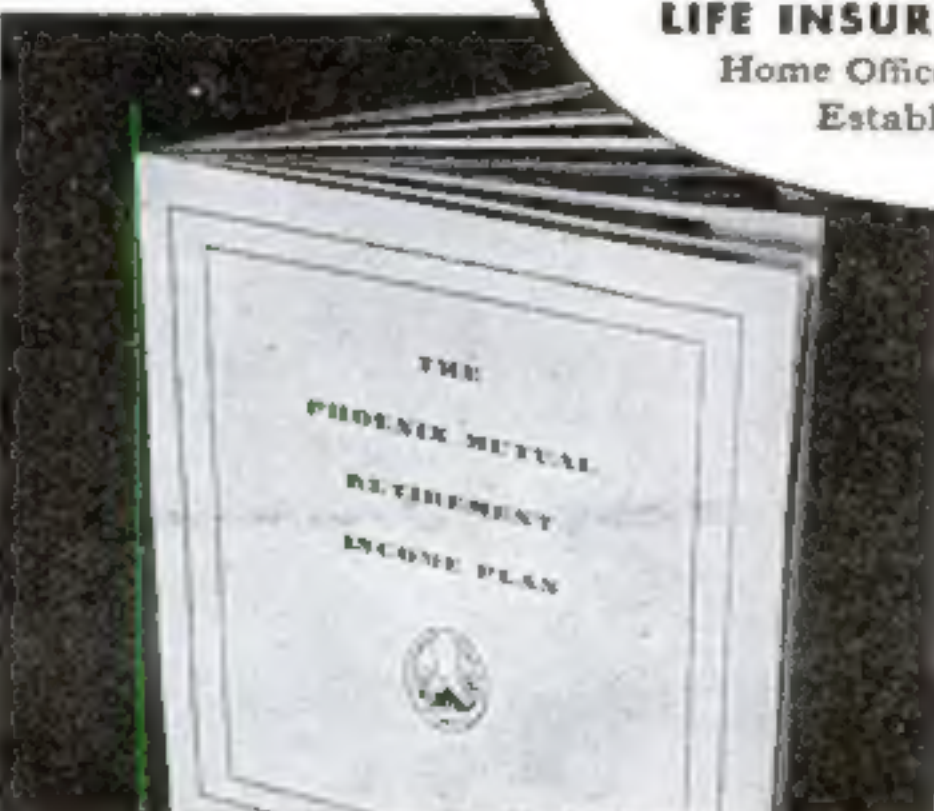
How much does it cost? When we know your exact age, we shall be glad to tell you. In the long run, the Plan will probably cost nothing, because in most cases, every cent and more comes back to you at retirement age.

Write your date of birth in the coupon below and mail it today. You will receive, without cost or obligation, a copy of the illustrated booklet shown below. It tells all about the Phoenix Mutual Retirement Income Plan. Send for your copy now. The coupon is for your convenience.

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Where the Canaries Sing Bass

—and we manicure our nails in cigar cutters
by "Bugs" Baer, Famous Author and Humorist

AN UNGRATEFUL child is sharper than a serpent's tooth. But it is dull compared with a Gillette Blade, which is so keen that a giant lightning bug couldn't find its edge even if he had two tails.

I am Mayor of Rufftown, which is so tough the canary birds sing bass and we manicure our nails in cigar cutters. Nobody in our town ever shaved until the Gillette Blade was invented. Now we all shave twice a day, including the children, Aunt Ella and the iron deer on the front lawn.

But don't forget, nobody wants to saw his whiskers with a blade that is rougher than a lumberjack's table manners and duller than a lecture on the medicinal properties of slippery elm. That's where the Gillette Blade comes in. We'd get rich if we had the edge on contract bridge like Gillette has the edge on the rest of the blade world.

We all want nice, smooth, enjoyable shaves and we've all got a right to them. The Constitution of the United States guarantees that in the paragraph about the pursuit of happiness.

To get the lowdown on this shaving thing, I took a cruise through the Gillette factory in Boston recently and watched a blade go through 180 minor steps so that a shave would not be a major operation. I discovered

there isn't any microscope powerful enough to see the shaving edges of a Gillette Blade.

I have been using Gillette Blades for twenty five years, man and boy, so I ought to know what I'm talking about when I say that the Gillette Blade gives the world's cleanest, most comfortable shaves.

* * *

In his inimitably humorous way, "Bugs" Baer certainly has hit the nail right on the head. Like Frank Buck, Grantland Rice, Graham McNamee and many other famous men, he agrees that the Gillette Blade is the finest that science can produce. If you have strayed away from Gillette Blades, may we suggest that you now buy a package, and get ready for a new thrill in shaving! You will be surprised how easily and quickly it whisks off stubborn bristles without pull or irritation. This is because the Gillette Blade is especially processed for shaving tender faces. Buy a package today. Slip one into your razor tomorrow morning and see why millions of men will use no other blade.

With these important facts before you, why let anyone deprive you of shaving comfort by selling you a substitute! Ask for Gillette Blades and be sure to get them.

Tune in on Gillette's sensational new radio program—CBS network—Coast to Coast—Sunday night—10 P. M. E. S. T.

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Build a Ship Model FOR CHRISTMAS



KIT V contains materials for a clipper

SHIP models are always highly appreciated as Christmas presents. You can therefore solve at least one of your gift problems by making a model or, if you know some one interested in model making, by giving him one of our construction kits. We now have a large variety of kits of materials with full-size blueprints, and blueprints alone for many more ship models (see page 90).

Select the model according to the time you can give the work and the person for whom it is intended. The simplest of our models, which require the least time to make, are listed under the heading "Model-of-the-Month Kits." The stories about the *Bounty* and *Hispaniola* are known to everyone. Of particular interest, too, is our new kit for an oil tanker, listed as 4M. Although the price is only \$1.50, the oil-tanker kit has the hull partly shaped and contains lifeboats, anchors, paints, and complete materials.



KIT 4M is for building this oil tanker

The models listed under "Simplified Ship Model Kits" take only a little longer to make. The *Sea Witch*, a picturesque clipper ship, appeals to both men and women, and the *Manhattan* and *Indianapolis* to men and boys.

Our standard kits are larger and require more time to make into models, but the finished product is worth the effort.

Each ship model kit contains a complete assortment of carefully selected raw materials, designed so that preliminary work is reduced to a minimum. Full-size blueprints and all necessary instructions are included.

Two kits for whittlers and two furniture kits that contain completely machined, ready-to-assemble parts, are also available.

MODEL-OF-THE-MONTH KITS

- M. Aircraft carrier *Saratoga*, 18-in.....\$1.00
- N. Four U.S. destroyers, each 6¼-in. .75
- O. Liner S.S. *St. Louis*, 11-in..... 1.00
- R. U. S. cruiser *Tuscaloosa*, 11¼-in... 1.00
- U. *Hispaniola*, the ship in "Treasure Island," 7-in.50
- Z. H.M.S. *Bounty*, 11½-in..... 1.50

(Continued on page 9)

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OUR CONSTRUCTION KITS

(Continued from page 8)

- 1M. Show boat, illuminated, 14-in..... 1.50
- 2M. Ocean-freighter, 14-in..... 1.50
- 3M. Yacht *Nourmahal*, 8 1/2-in..... 1.00
- 4M. Oil tanker, 14-in..... 1.50

SIMPLIFIED SHIP MODEL KITS

- F. Liner S.S. *Manhattan*, 12-in..... 1.00
- H. Cruiser U.S.S. *Indianapolis*, 12-in. 1.50
- J. Clipper ship *Sea Witch*, 13-in..... 1.50

STANDARD SHIP MODEL KITS

- A. Whaling ship *Wanderer*, 20 1/2-in.....\$7.40*
- D. Spanish galleon, 24-in..... 6.95*
- E. Battleship U.S.S. *Texas*, 3-ft..... 7.45*
- G. Elizabethan galleon *Revenge*, 25-in. 7.25*
- L. Farragut's flagship *Hartford*, steam-and-sail sloop-of-war, 33 1/2-in. hull..... 8.45*
- Q. Privateer *Swallow*, 12 1/2-in. hull.... 4.95†
- V. Clipper *Sovereign of the Seas*, 20 1/2-in. hull 4.95†
- Y. Trading schooner, 17 1/2-in. hull..... 4.90†

Here is Rob, one of the six Scotties, all different, that can be made from our special whittling kit No. 8 in the list below. Six shaped blocks are in each kit



- 2S. U. S. Navy Destroyer *Preston*, 31 1/2-in. hull 5.95*
- 3S. *Constitution* ("Old Ironsides"), 21-in. hull 6.50*
- 4S. Clipper ship *Great Republic*, 31 1/2-in. hull 8.40*
- 5S. Coast Guard patrol boat of new 165-ft. class. Full-hull model, 1/2 in. scale, the hull being 20 3/4 in. long..... 4.95*

MISCELLANEOUS

No. 4. Solid mahogany book trough 22 1/2 in. long, 9 1/2 in. wide, and 24 3/4 in. high over all. Ready to assemble, with finishes..... 5.30*

No. 5. Solid rock maple hanging wall rack with one drawer, 19 1/2 in. wide, 33 3/4 in. high. Ready to assemble and stain included..... 5.75*

No. 7. Whittling kit with two shaped blocks for making sea captain 5 1/2 in. high. A knife, three bottles of paint, pocket sharpening stone, and instructions are included..... 1.50

No. 8. Whittling kit for six different Scotties. Each is 2 by 2 1/4 in., sawed to shape. Paint, paintbrush, instructions, etc..... 1.00

NOTE: If you live west of the Mississippi River or in Canada, add 50 cents to all prices marked with an asterisk (*) and 25 cents to all prices marked with a dagger (†).

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Our Readers Say



Goes Roundabout To Find Length of Bee-Line Road

AFTER using up three eight-hour days, thirty-three sheets of paper, and thirty-five feet of adding-machine tape for making my calculations, which called for the use of trigonometry, calculus, three graphs, the slide rule, and seven-place logarithm tables, I finally arrived at a solution to the bee-line road problem submitted by F.M., of Aurora, Ill. The length of the road AB is approximately 23.74 miles, while OA is 18.29 miles; OB, 14.47 miles, and the angle OBA, fifty-two degrees, twenty-six and a half minutes. All these figures are approximate, and it is my belief that the exact answer is unobtainable since the problem involves trigonometry and hence incommensurable numbers. Finding angle OBA means the solving of a sixth-degree trigonometric function with fourteen terms, and this can be done only by "cut-and-try" methods. If anyone has found any easier method of solving this problem I should like to have him let me know about it—G.W.P. III, Vergennes, Vt.

GOSH! IT'S EASIER TO BUILD THE ROAD AND THEN MEASURE IT!



Just Itching To Know About Ivy, Says This Reader

HAS anybody found a good way of getting rid of poison ivy? I don't mean the infection; the plant is all I'm interested in right now, although for about three weeks I was itching for something that would quickly cure the dose that had me laid up. There was a lot of the ivy growing in the light soil near my house, so I set about uprooting the plant, after taking what I thought were adequate precautions. After all my work and martyrdom, the darn stuff grew in the same place again. So if anybody has a really tried and true method for getting rid of the plant, I wish he would let me in on the secret before next summer gets here and I find myself in the same fix.—W.B., Worcester, Mass.

It Makes Us Tired Just Thinking About It

IN ANSWER to E.G.D., of Jaro, Philippine Islands, I would like to point out that a man pushing against a rock which he can't move is doing no work. The apparent paradox arises from the fact that, commonly speaking, work means the energy expended, while scientifically work means the effect accomplished, which is measured by the acting force and the distance through which it acts. Thus a pillar holding up the roof of a Roman temple wouldn't have done a lick of work, even if it had stood until modern times. So, Atlas wasn't doing any work, but sure was putting forth energy.—W.L.S., St. Joseph, Mo.

I GUESS THIS ISN'T WORK EITHER!



Hope the Office Whistler Doesn't Read This

THE letter by S.G.V., of Akron, O., brings to mind an amateur experiment of my own. Browsing through the encyclopedia one day, I learned that sounds are formed by the vibrations of the lips in whistling, and by the vibration of the vocal cords in speaking, singing, or humming. Why not whistle and hum at the same time, then, since they're more or less independent actions? It turned out to be easy. In fact, I found it perfectly possible to hum one musical note and whistle a different note simultaneously. Naturally it's hard to control the two different pitches at once—but I'm wondering whether a practiced performer might not be able to whistle a tune accurately while humming a countermelody, or vice versa. A one-man duet should be an amusing novelty at least, and—who knows?—it might open up brand-new possibilities in the amusement field!—B.S., Pasadena, Calif.

Another Snake Question Rears Its Ugly Head

REMEMBERING the long-drawn-out controversies on hoop snakes, rattlesnakes, and other reptiles that have raged in your Our Readers Say pages, I hesitate to bring up another snake question. However, some snake-wise reader may be able to settle it quickly and painlessly. During a recent visit to the Great Smoky Mountains in eastern Tennessee, I was told by mountaineers that there are no snakes in the higher reaches of the mountains, the explanation being that the reptiles do not like the balsam trees that flourish along the tops of the ranges. Does this statement have any foundation in fact, or is it just another snake story? One thing, at least, can be said for it: it makes you feel a lot more comfortable—as long as you are on top of the mountain.—T.A.S., Washington, D. C.

WHO CARES WHAT'S ON THE OTHER SIDE OF THE MOUNTAIN?



Irrigation Dam Proves To Be a Real Weather Maker

A RECENT item in our local newspaper made me dig through my old copies the other day and reread the article, "Weird Schemes To Make It Rain." It seems that airplane pilots who fly regularly over Mead Lake, behind Boulder Dam, report that the new body of water stored there is slowly but surely changing the climate of the surrounding territory. Because of the additional moisture in the air and a cooler atmosphere, experts have hopes that the yearly rainfall for the area will be increased. After trying deliberately to alter the weather and failing, man seems to have turned the trick by accident. Maybe it will be possible to reclaim the desert with a few well-placed man-made lakes, and there may be a possibility that this discovery will lead to new

developments in our continual search for ways in which we can control the vagaries of the weather. At least, it's an idea that may deserve more thought.—F.T., Tucson, Ariz.

It Sounds (or Smells?) Like a Good Idea

I READ recently about a British scientist who had discovered the microorganisms responsible for the scents of fresh-ploughed fields, of earth after summer rains, and so on. If that is so, imagine some of the results. Women could wear woodland perfumes with their tweeds; a week-end invitation would be vastly more alluring with the country scents attached to the note; perhaps your editors would even be able to sniff at incoming mss. and say, "Ah, this is from that Jenkins chap, up in the Maine woods, I think!"—R.H., Tucson, Ariz.

AREN'T THE CLOTHES ENOUGH OF A BLUFF?



Let's Add Some Wings So It Can Fly, Too

DURING the last few years, you've shown us all sorts of amphibious craft—tanks, automobiles, bicycles, and submarines. Now how about an amphibious rowboat, with complete plans that will show us amateur craftsmen how to build it? On land, it could be propelled by a sail or by a simple mechanism geared to the wheels. In the water, ordinary oars, a hand-powered propeller, or the sail could be used. Such a craft, with its wide range of uses, would be certain to have lots of appeal to every one who is interested in outdoor sports, and it might itself give rise to a new sport. One could be saved a lot of trouble in getting his boat to a lake if he could just rig a sail and let the wind push him to the water.—J.R.A., Northfield, Mass.

Rake-Handle Blisters Inspired This Idea

THE following idea always gets a laugh every time I suggest it, but I can't see why it wouldn't be practical. During the fall of the year, leaf raking becomes a national nuisance, so why not devise a vacuum-cleaner arrangement to remove the leaves from our lawns? Each city or county could maintain giant cleaners like those used in chimney cleaning. The collected leaves then could be ground, pressed into blocks, and sold as kindling. The revenue from these, plus the money made by selling rotted leaves as fertilizer, would more than pay for the machines and their opera-



tion. But, as far as I'm concerned, anyhow, being relieved of the task of raking leaves every week would be the best reason for its use.—H.L., Siloam Springs, Ark.

Trailer City, It Seems, Might Roll Into Trouble

Just think what would happen if that trailer city, visioned by J.P., of Salt Lake City, Utah, really existed! Suppose a large freight shipment was enroute to Chicago from New York, when, all of a sudden, Chicago decided to move to Kentucky. Who would pay the additional freight, the manufacturer or the consumer? And that's not all—what about water? Are we to have a nationwide hook-up of water pipes and sewerage systems? Or perhaps each trailer home would have a reel of hose that it could pay out as it went along, thus laying down its own pipe line. With everybody moving about as they pleased, the whole postal system would be upset and we'd have no use for postmen.—F.deN., Chicago.

WHAT'S A
POSTMAN,
POP?



Wants More Light On Radium Compounds

DURING all the years that I have been reading P.S.M. I have yet to see a long article on radium and radium compounds. A number of your readers, I am sure, don't know that the element radium is not used for treating cancer, but rather, radium bromide or some other radium compound. And don't forget to give us something about the spinthariscopes.—J.H., Detroit, Mich.

Hollywood Adds One to Gus's Fan Mail

I, FOR ONE, don't think you give Gus Wilson and the author, Martin Bunn, enough consideration. How about longer stories about the Model Garage? One page isn't half enough, particularly when Gus gives the low down on driving tricks, as he did in the September issue. Even two pages would be too little. We all drive cars, but we all don't own microscopes, chemistry laboratories, and home workshops, and most of us, too, could use some more dope about good driving and the care of our automobiles, as is shown by the increasing number of accidents.—P.S., Hollywood, Calif.

Who Can Tell How To Make a Photostat Camera?

ISN'T there some way that photographic copies can be made of printed matter without a lot of expensive equipment? As a hobby, I've been collecting material on a rare species of plant, and copying all the information in longhand is quite a task. I'm wondering if some reader hasn't devised a photostatic machine that can be built easily from an old camera and a few other odds and ends. With an arrangement like that, I could photostat whole pages from reference books, and get copies of the illustrations as well as the text. I'm rapidly developing a bad case of writer's cramp from my labors at the library, and if somebody doesn't come to the rescue soon with a machine to do the work, I'll turn into an enormous hand with just a vestige of a body attached to it.—C.A.W., Cincinnati, Ohio.

HALP!



He Says He's Too Busy Now To Draw His Breath

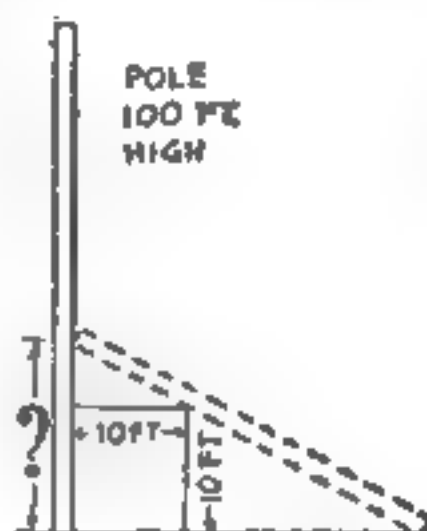
WHY don't you publish something in your magazine about cartooning? I'm sure I wouldn't be the only one interested. There must be a great many readers who have some ability or interest in caricature. Maybe the cartoonist for Our Readers Say pages could give us a few pointers. How about it?—J.P., Saginaw, Mich.

Maybe He Will Blow Us To A Cross-Country Trip

FOR a long time now I have been wondering why some one doesn't experiment with a large-scale transportation system based on the same principles as the pneumatic tubes used in department stores. It seems to me that this would be a fast and safe method of travel, enabling one to skim across the continent in less than a day. Powerful fans stationed at intervals would furnish the necessary air power. H.S., Atlanta, Ga.

Here's a New Problem For the Math Sharks

THE mathematical problems that appear in the Our Readers Say pages have always held special interest for me. Some of them I have been able to solve only after considerable calculation, and on others I have failed miserably. This only heightens my interest and enjoyment, however, and to keep the ball rolling, here's one for the other sharks. If a pole 100 feet high is erected against the side of a building ten feet high and ten feet square, how high from the ground will the pole have to break so that the tip will touch both the ground and the edge of the building, with the broken edges still touching?—R.H., Baltimore, Md.



What's a Million Years Between Astronomers?

AFTER reading "How Will the World End?" I got to thinking about the small wandering planet that just recently missed the earth by only 1,500,000 miles. It brought to mind the story about the man who was attending a lecture on astronomy. The lecturer made the prophecy that the world would come to an end in fifteen billion years. The man became wildly excited until his friends assured him that fifteen billion years was a long time. "Fifteen billion?" he questioned. "Gosh, for a minute I thought he said 'fifteen million.'"—J.X.G., New Orleans, La.

Has Novel Idea for Making Enlarger Bellows

HERE is a simple stunt that M.G., of Brooklyn, N. Y., can follow in making the bellows for an enlarger. Get several large paper envelopes of the brief-case type and remove the accordionlike folds from the sides and bottoms. When these have been cut to the desired size, cemented together, and painted with light-tight paint you have an excellent bellows.—M.L.G., Jr., Lewisburg, W. Va.

Model Maker Would Go Back To the Horse and Buggy

I SEE that J.E., of Kansas City, Mo., wants to build models of the early horseless carriages, so I'm putting my shoulder to the wheel and helping to push the model-automobile suggestion along. I, too, am interested in model making, and beside the gasoline buggies, I would like to have plans for models of

horses and buggies. As a constant reader and a photo fanatic, I also demand more about table-top photography of early American horse-and-buggy days.—P.G.W., Northfield, Minn.

How an Ape Made a Monkey Out of a Professor

SO CHILDREN now are being put in rooms where psychologists spy on them to study their behavior when left alone! I'm reminded of a yarn I once heard about a professor and a monkey. As it was told to me, the scientist locked the animal in a room and peered in through the keyhole to see what it was doing. He found the ape peering out through the keyhole to see what the professor was doing. Wouldn't it be funny if the kids turned the tables as neatly on their observers? Maybe some day a precocious youngster will give us a scholarly book on the behavior of adults, with special reference to the antics of child psychologists.—A.G.H., Lafayette, Ind.

WHAT'S HE
WATCHING
ME FOR?



Low-Hung Highway Lights Cause Trouble, He Says

IN ANSWER to R.O.D., of Tulsa, Okla., about the idea of low-hung highway lights, I would like to point out the results of an actual experiment along those lines. In Dallas, Tex.,—the Centennial City—lights were installed two or three feet above the surface of the road on both sides of the huge triple underpass completed there recently. These lights have proved to be a direct menace to traffic! Low-hung lights look exactly like approaching headlights, confusing the drivers and causing them to have accidents in trying to dodge oncoming autos. As a result of the failure of these lights to provide satisfactory vision, it has been necessary for the city of Dallas to spend thousands of dollars in removing the lights from one side of the underpass and it will cost thousands more to complete their removal. Because of all the trouble they brought, the lights have been nicknamed "blunder lights."—E.B.W., Longview, Tex.

Would Build a Game Table If We'd Tell Him How

IT'S BEEN a long time since P.S.M. has given us anything on building a miniature pocket-billiard table. Not a toy table, but a carefully planned and proportioned portable table-top unit. One about a third the regular size would be inexpensive to build, and yet would call for all the skill needed for playing on a standard table.—S.H., Brooklyn, N. Y.

Admires Polished Style of Furniture-Finish Series

JUST a word of appreciation for the excellent series of articles on furniture finishing, by Ralph G. Waring. It is just what I have been looking for. His instructions are so clear, thorough, and to-the-point that even reading them is a delight. It is not often that an expert craftsman is found who can impart to others his own skill. They should be preserved in booklet form. My sincere thanks to Mr. Waring and to P.S.M. for publishing this instructive series.—J.E.G., Fort Smith, Ark.

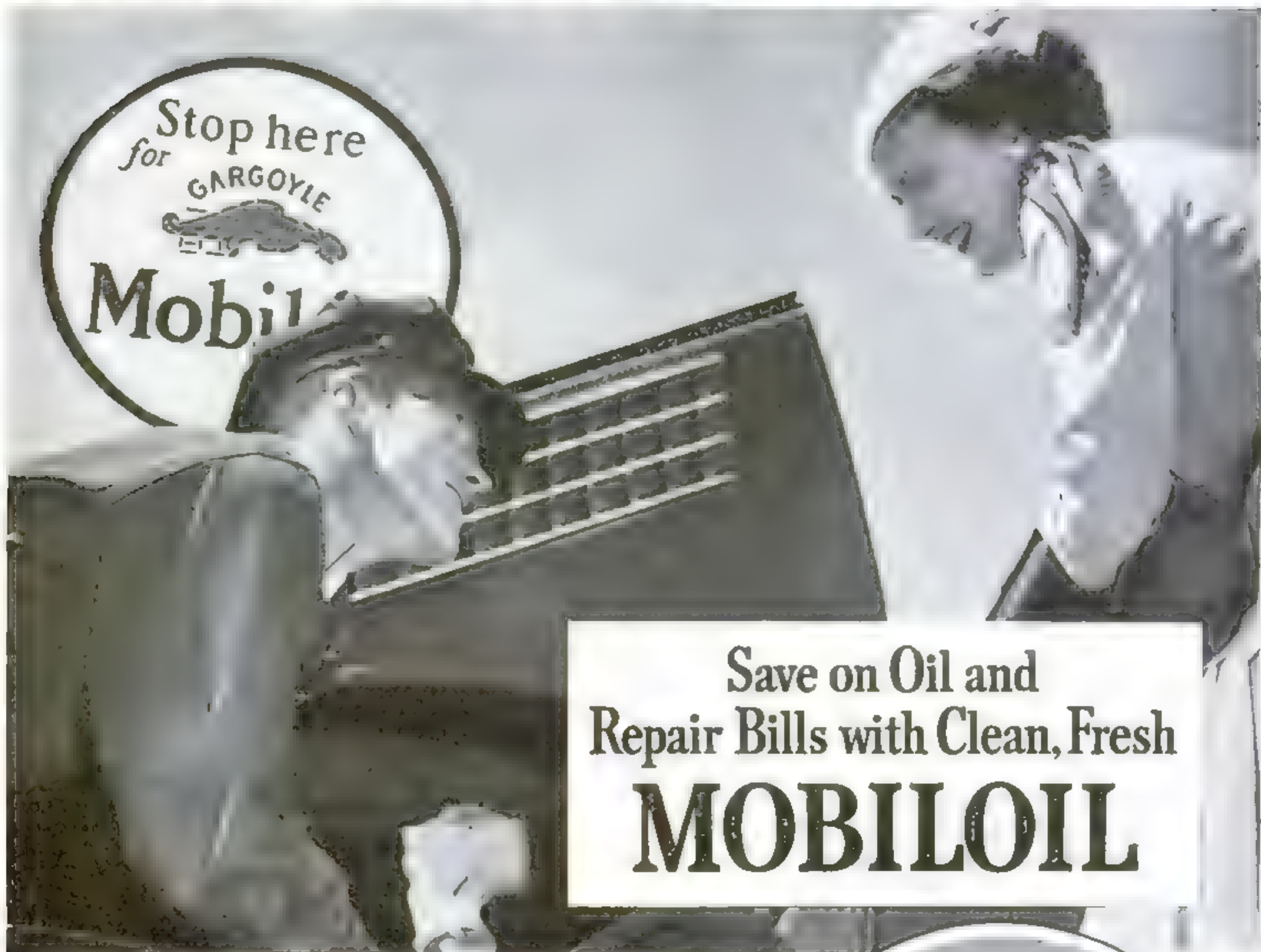
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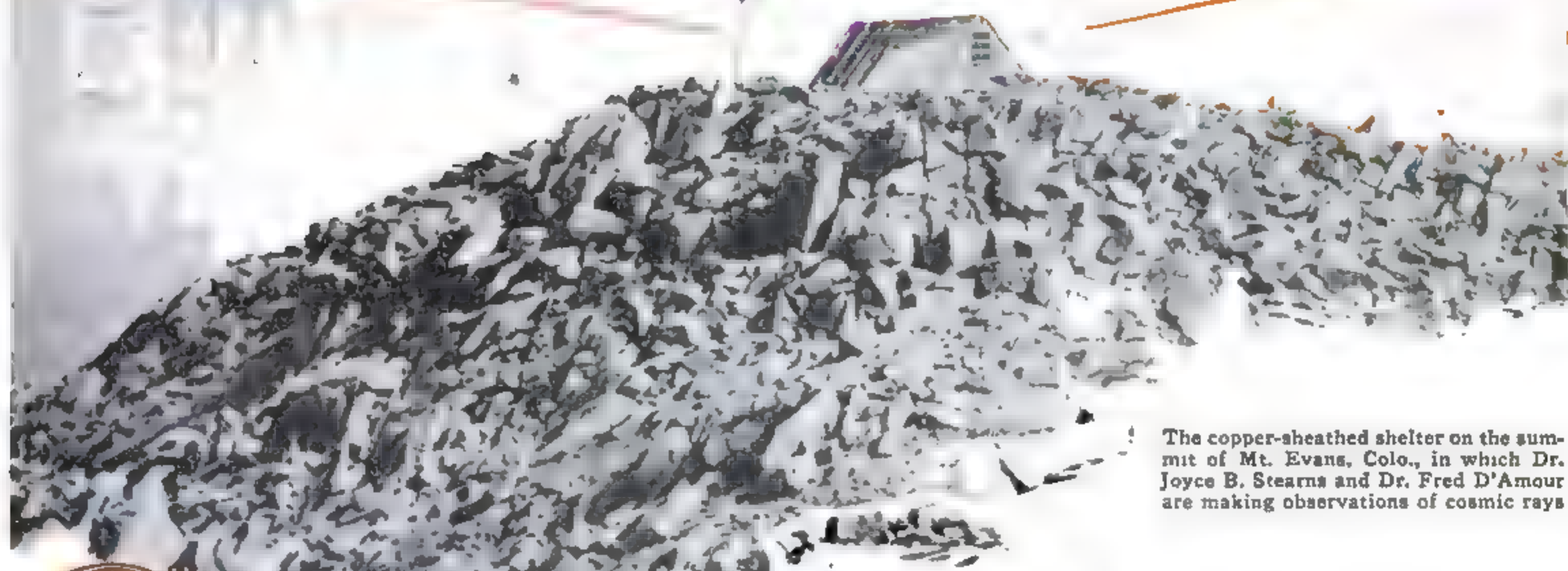
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RAYMOND J. CROWN, Editor



The copper-sheathed shelter on the summit of Mt. Evans, Colo., in which Dr. Joyce B. Stearns and Dr. Fred D'Amour are making observations of cosmic rays

Cosmic Rays Trapped *in* MOUNTAIN-TOP LABORATORY



Dr. Stearns, at left, listening to the energy bullets from space striking a ray-counting instrument after passing through a lead plate. The sounds are heard through an amplifier and loudspeaker

*The Story of a Strange Outpost of Science,
Nearly Three Miles Above Sea Level, Where
Man Seeks the Answer to a Riddle of Nature*

By JOHN E. LODGE

ON A lonely 14,000-foot mountain peak, fifty miles west of Denver, Colo., two scientists have just moved into the only house of its kind on earth. Shaped like a wedge tent and completely sheathed with copper, it stands among bare, wind-bitten boulders, far above the timber line. It is the world's first permanent cosmic-ray laboratory.

Here, Dr. Joyce B. Stearns and Dr. Fred D'Amour, of the University of Denver, are studying the mystery bullets which bombard the earth from outer space. With clicking, chattering instruments, they will seek answers to such teasing problems as the exact nature of the rays, where they are born, and how they affect human life.

Few riddles have aroused greater scientific curiosity than these. Believed to originate in the empty spaces of the sky—the dark areas between the galaxies—cosmic rays are the largest “packets” of energy known. They can penetrate lead 100 times as far as X rays. Recent tests indicate that they are in part electrically



Motor trucks climbed to nearly three miles above sea level to carry the material for this lonely outpost of science. Copper sheets and screens guard against electrical disturbances

charged particles and in part radiant energy similar to light and heat. They are unlike anything else we know, and they are engaging the attention of scientists around the world.

The two-room, mountain-top laboratory where the Colorado experimenters will work was especially designed to withstand everything from wild animals to February blizzards. It was constructed in Denver, knocked down, and then hauled by a caravan of eight motor trucks to the top of Mt. Evans, almost three miles above sea level. The twisting trail the cars followed was constructed especially for the purpose. Only one other road in the world goes so high.

At some points on this perilous trip, the laboring machines hugged the inside of the trail until their fenders brushed along the rock walls to keep from slipping over precipices. Inching around hairpin turns, they moved at a snail's pace up the steep incline until all were safely at the top. There, skilled workmen quickly assembled the structure and roofers covered it with paper-thin sheets of copper.

This material protects the interior of the building from electrical disturbances, offers the least resistance to cosmic rays, and at the same time provides sufficient strength to withstand the gales and blizzards of the mountain top. As a further protection against electrical interference, all windows are screened with copper, and heavy cables of the same material run



Dr. Stearns holding a large Geiger tube, a sensitive instrument that makes the impact of cosmic rays audible in an amplifier, thus enabling observers to note their frequency

Scientific hermits—the two observers at the table on which they work and eat as they keep their vigil on top of the world

from the roof deep into the granite to which the structure is anchored, ending in moist earth surmounted by a layer of charcoal.

Within the copper shell of this lonely outpost of science, a battery of ray counters, gas-filled Geiger tubes, will record the shifting pulsations of cosmic energy. Seldom more than a foot in length, each of these glass tubes contains a copper cylinder and a rod of the same metal. One terminal of an electric generator is connected with the rod, the other terminal with the cylinder. Ordinarily, the current is unable to bridge the gap between the two. When a cosmic ray enters the tube, however, it ionizes the gas, or fills it with electrified particles which act as "ferry boats," carrying the current across the opening.

These midjet flashes of laboratory lightning are far too small to see. But the sound is amplified into a metallic click. At sea level, the clicks that record the passage of cosmic rays occur about one every four seconds. In the thin air of the mountain top, they are many times as numerous, the amplifier clattering continually like chickens pecking on a tin pan.

While Dr. Stearns is busy with his Geiger tubes and other apparatus, Dr. D'Amour will concentrate upon the fascinating problem of what these potent rays do to living things. Generation after generation of white rats will live in the mountain-peak laboratory under the constant bombardment of the rays. The effect upon their evolution will offer valuable data for science to study. At present, there is no evidence that cosmic rays are injurious to humans.

A thousand miles away from the Colorado outpost, on the shores of Lake Michigan, two other experimenters—the famous Nobel Prize winner, Dr. Arthur H. Compton, and his research assistant, Haydon Jones—are tuning up a twelve-ton, electromagnetic "speed trap" for the study of cosmic rays.

Five miles of copper wire, three quarters of an inch thick, are wound around the two poles of the giant magnet. To carry off the intense heat generated by the current, the wire is enclosed in oil which, in turn,



is cooled by a stream of running water.

Connected with the magnet will be a Wilson "cloud chamber," a glass box filled with gas saturated to the point where an electric charge passing through it leaves a trail of minute water droplets which can be photographed by an automatic camera. Thus, the path of an invisible ray can be recorded on film. If he can bend the cosmic rays that enter the electromagnetic field of the new apparatus, and then photograph their trails, Dr. Compton will have a key to measuring their energy. For, it is known that the higher the energy of the particles, the less they are deflected by such a pull.

In 1929, a Russian scientist succeeded in photographing the "ghost trails" of cosmic rays in a "cloud chamber." But, even though the chamber was in a magnetic field, the paths were straight. The velocity of the particles was so great they were unaffected by the magnet.

In the past, apparatus available for such work could measure no more than 20,000,000,000 volts. The Compton device is expected to lift the limit to 40,000,000,000 volts. In the 7½-inch space between the poles, the magnet can exert a pull of six tons. One out of every fifteen cosmic rays entering the magnetic field, it is estimated, will be traveling in the right direction to be photographed.

A large collection of these ghost trails will give science a clearer insight into the nature of the visitors from outer space. In addition to providing a yardstick for measuring energy, the experiments are expected to settle the question of whether the particles are positively or negatively charged.

A few years ago, extensive experiments at Mexico City with a cosmic-ray "telescope" indicated that the former is true. Dr. Thomas H. Johnson, of the Bartol Research Foundation of the Franklin Institute, Philadelphia, made the tests. His instrument consisted of three ray counters placed in line so only the cosmic rays traveling directly toward the tube would be recorded by all three. Pointing this curious piece of apparatus at different parts of the sky, he found that the major ray

COSMIC RAYS

Streaming from outer space, the most powerful rays known bombard the earth. They electrify gases, smash atoms, change one element into another. How do they affect human life? How can their illimitable power be harnessed? This latest attack upon the mystery of cosmic rays may answer these puzzling queries.

stream travels from west to east. As the magnetism of the earth would naturally deflect positive electrical particles toward the east, it is assumed that cosmic rays are composed, at least partially, of positive electricity.

During the thirty-five years which have elapsed since the first hint of their existence, the story of cosmic rays has been one long succession of riddles. It was, in fact, a riddle which led to their discovery.

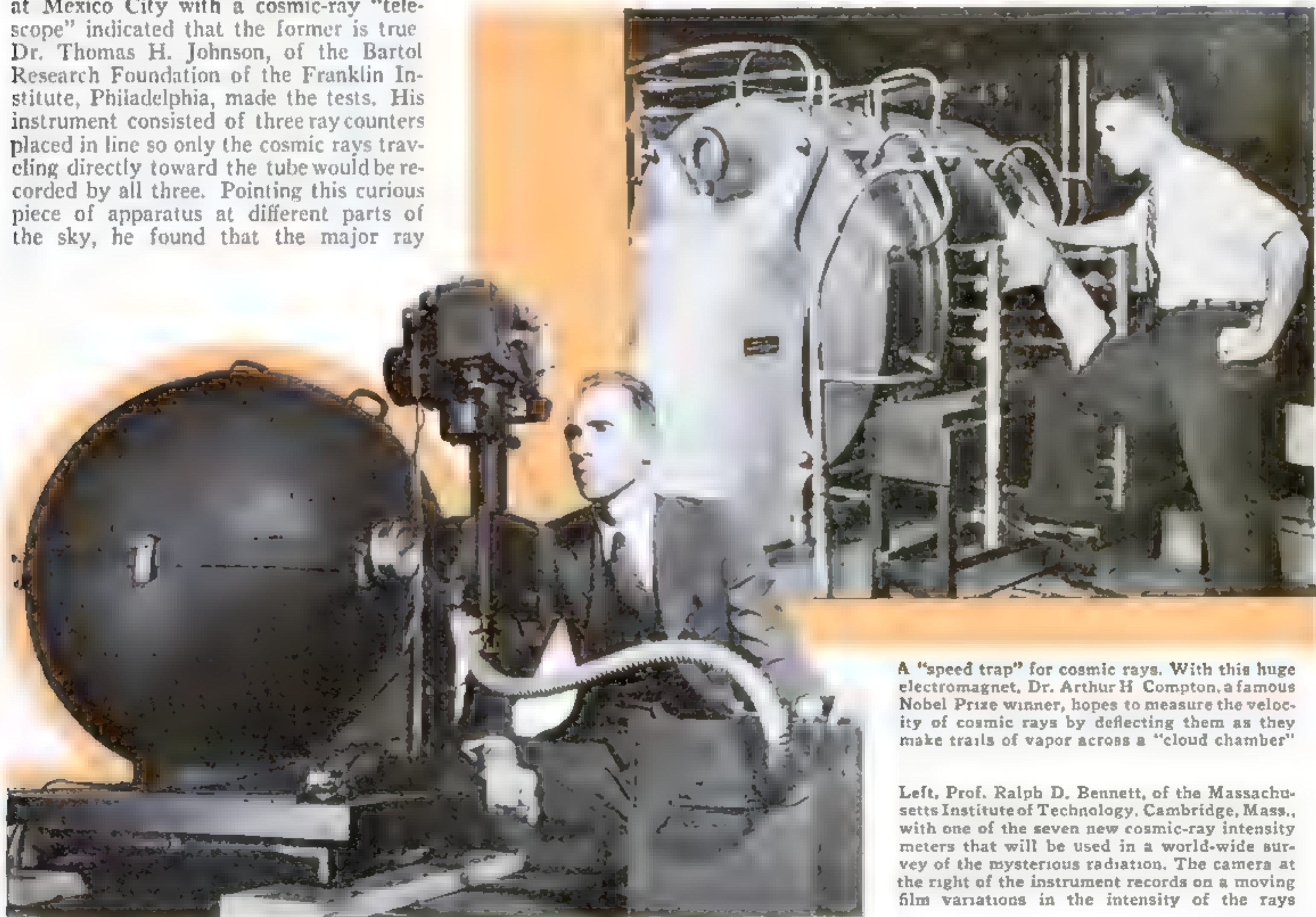
Back in 1901, workers in an English laboratory noticed a puzzling thing. They were testing the strength of radium with a small gold-leaf electroscope. In this instrument, a tiny electrical charge holds strips of gold leaf apart. When radium rays enter it, they ionize the air and permit the charge to escape, the rate of this

leakage indicating the strength of the radium bombardment. But, the English scientists found, the charge leaks away gradually even when the electroscope is put away in its container. Various explanations were offered. One was that there might be radium in the earth nearby; another, that the atmosphere might contain some radioactive element. For nearly a decade scientists here and abroad puzzled over the mystery.

Then, in 1910, came the balloon flight of A. Gockel. This young Swiss physicist sailed high over Germany, carrying a small electroscope in the open basket of his balloon. If the leakage observed by the English workers were due to radium in the earth or to a radioactive element in the atmosphere, the effect would be less at higher altitudes, for there the instrument would be farther from the ground and in thinner air. Instead, a topsy-turvy thing occurred. The higher the balloon went, the faster the charge was dissipated. Other ascensions verified his observation. Science was left facing a blank wall.

So matters stood until after the World War. Two Americans whose names bulk large in cosmic-ray research, Dr. Robert A. Millikan and Dr. Arthur H. Compton, had become interested in the mystery and after hostilities ended they took up the trail. Dr. Millikan was the first to prove the puzzling effect was actually the work of rays bombarding the earth from cosmic depths.

The story of his search is one of the epics of science. Climbing mountain peaks in the Andes, sending aloft sounding balloons on the *(Continued on page 115)*



A "speed trap" for cosmic rays. With this huge electromagnet, Dr. Arthur H. Compton, a famous Nobel Prize winner, hopes to measure the velocity of cosmic rays by deflecting them as they make trails of vapor across a "cloud chamber"

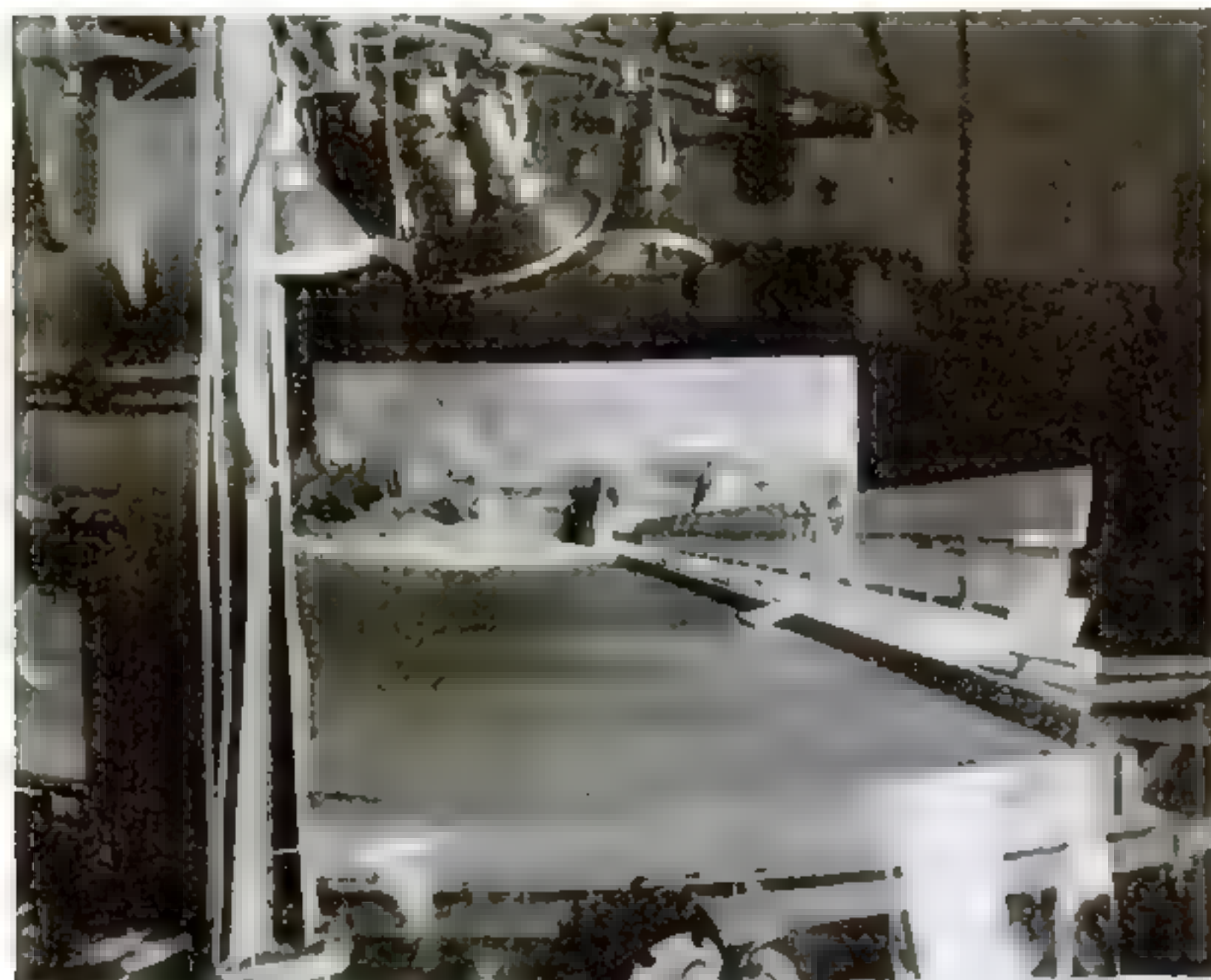
Left, Prof. Ralph D. Bennett, of the Massachusetts Institute of Technology, Cambridge, Mass., with one of the seven new cosmic-ray intensity meters that will be used in a world-wide survey of the mysterious radiation. The camera at the right of the instrument records on a moving film variations in the intensity of the rays

Real Scenery for *Popeye*

MIDGET SETS GIVE DEPTH TO NEW MOVIE CARTOONS



A technician turning a small hand crank which moves the table holding the scenery. A graduated scale shows how far it should be turned between two pictures



LIKE immense slices of pie on a twelve-foot plate, curious miniature movie sets made of clay, wood, sponges, plaster, and cardboard now add new realism to animated cartoons by creating an illusion of depth. In the New York studios where Popeye, Betty Boop, and other famous characters of the screen cartoons come to life, such sets are replacing the flat, sketched-in backgrounds familiar in the past.

The conventional method of producing a cartoon reel has been to sketch the successive stages of the action on thin sheets of clear celluloid, called "cells," and then to photograph them against a background drawn on a strip of paper. Between photographs, each forming one frame, or picture, in the finished film, the celluloid sheets were changed and the background strip moved slightly. When run through the projector at sufficient speed, these successive movements give the impression of continuous action.

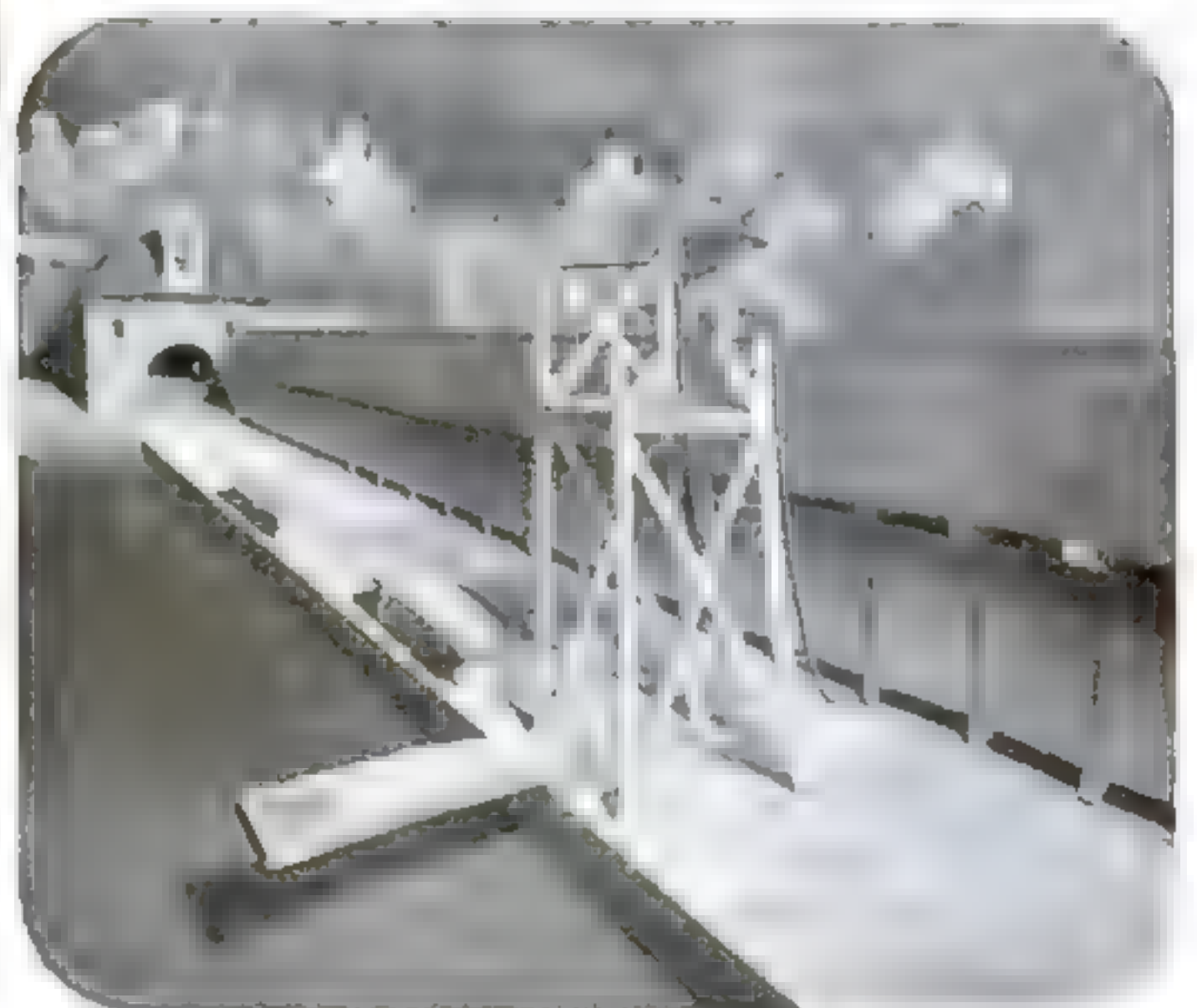
In the new technique, just introduced, the background strips are replaced with a three-ton, twelve-foot rotating table mounted on a framework of steel and holding mid-gut wedge-shaped settings. The celluloid sheets are placed in a window in front of the camera with the buildings, streets, trees, or mountains of the set showing through. The resulting photograph makes the figure sketched on the celluloid sheet appear to be in the midst of the scene formed by the scale-sized objects on the table behind. After each picture, the "cell" is changed and the table rotated slightly, just as the strip background was moved in the older technique described above.

NEW PERSPECTIVE FOR CARTOONS

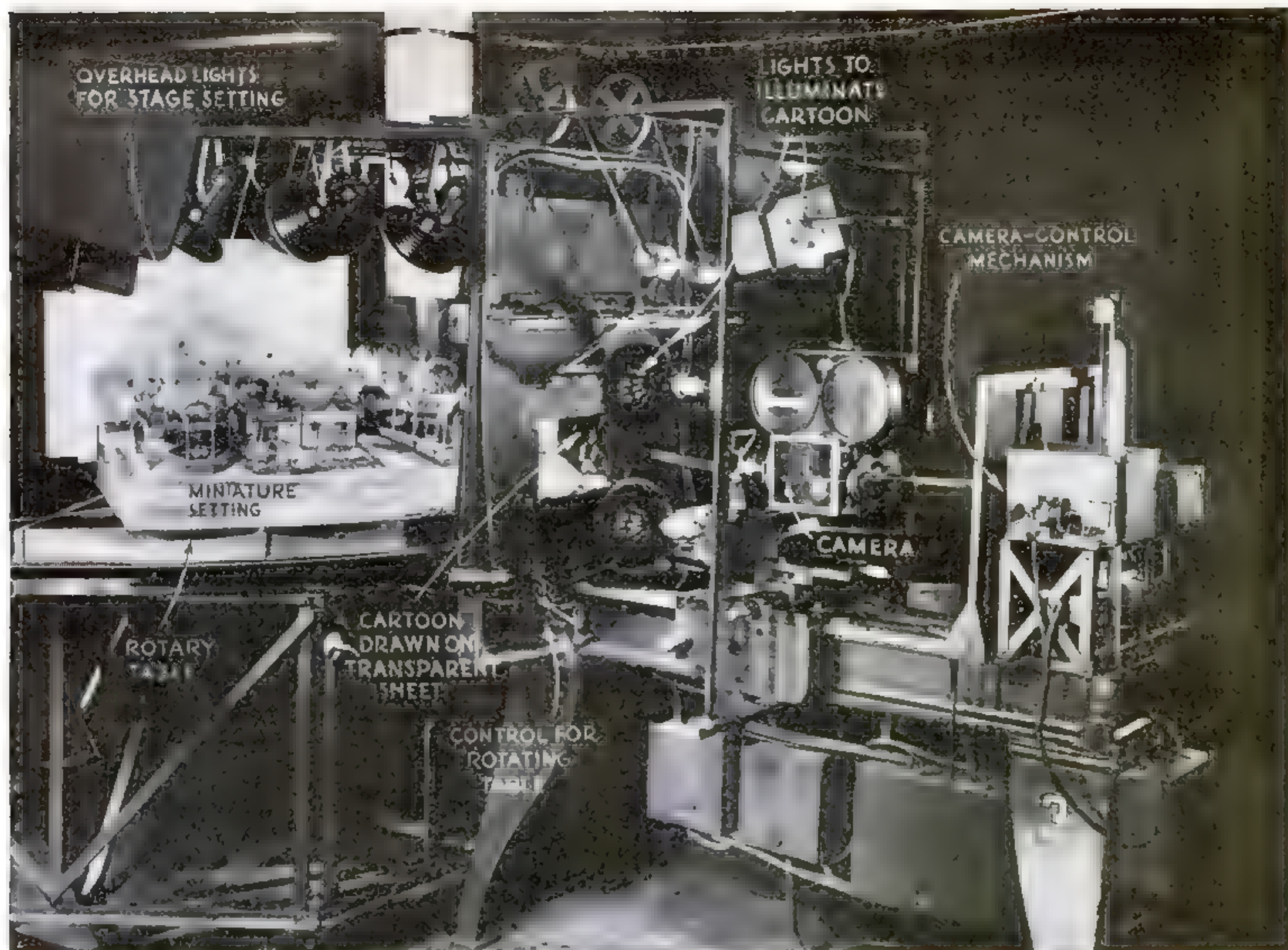
One of the wedge-shaped sets mounted on the revolving table. Note how the wall and walk grow narrower as they recede from the camera, giving the illusion of depth. As the table is turned, objects at the front of the scene move farther than those at the back, with realistic effect

Operating a series of gears, a small hand crank moves the table. Markers indicate exactly how far it should be rotated between the shots. In some instances, the rotating mechanism is connected with the motor that operates the camera, so that movements of the table are automatic. To insure precision adjustments of the camera and the "cell" holder, both are mounted on a heavy lathe bed.

All of the work of designing,



A "cell," or strip of transparent celluloid bearing one of the stages of the action, to be photographed against the prepared background. The photograph at the right shows how the scene pictured above appears to the eye of the camera



The complete apparatus for making animated cartoons with three-dimensional effect by the new process. Camera and "cell" holder rest on a lathe bed

building, and perfecting the apparatus, with its elaborate combination of trusses, cranks, and gears, was carried out in the experimental machine shop which forms a part of the New York studios. This research room is completely fitted up with electric machinery for working in both wood and metal.

The "slice-of-pie" shape of the sets gives them the proper perspective. Streets grow narrower as they recede from the camera; buildings diminish in size, and the ground slopes upward. The result is a realistic and natural perspective from the angle of the camera. If the sets were made square or rectangular and moved like a train of cars past the lens, they

would give the impression of depth, as the sets do now, but the farthest objects would move as fast as the nearer ones and the effect would be unconvincing. The vanishing point, or place where parallel lines seem to meet on the horizon of the sets, is at the center of rotation of the table, six feet from the sheet of celluloid.

To increase the sense of depth in the new cartoons, characters are seen walking behind trees and posts. This is accomplished by moving silhouettes, mounted on a special carrier, between the lens of the camera and the figure sketched on the sheet of celluloid. The silhouettes used for this purpose are made from flat plywood or

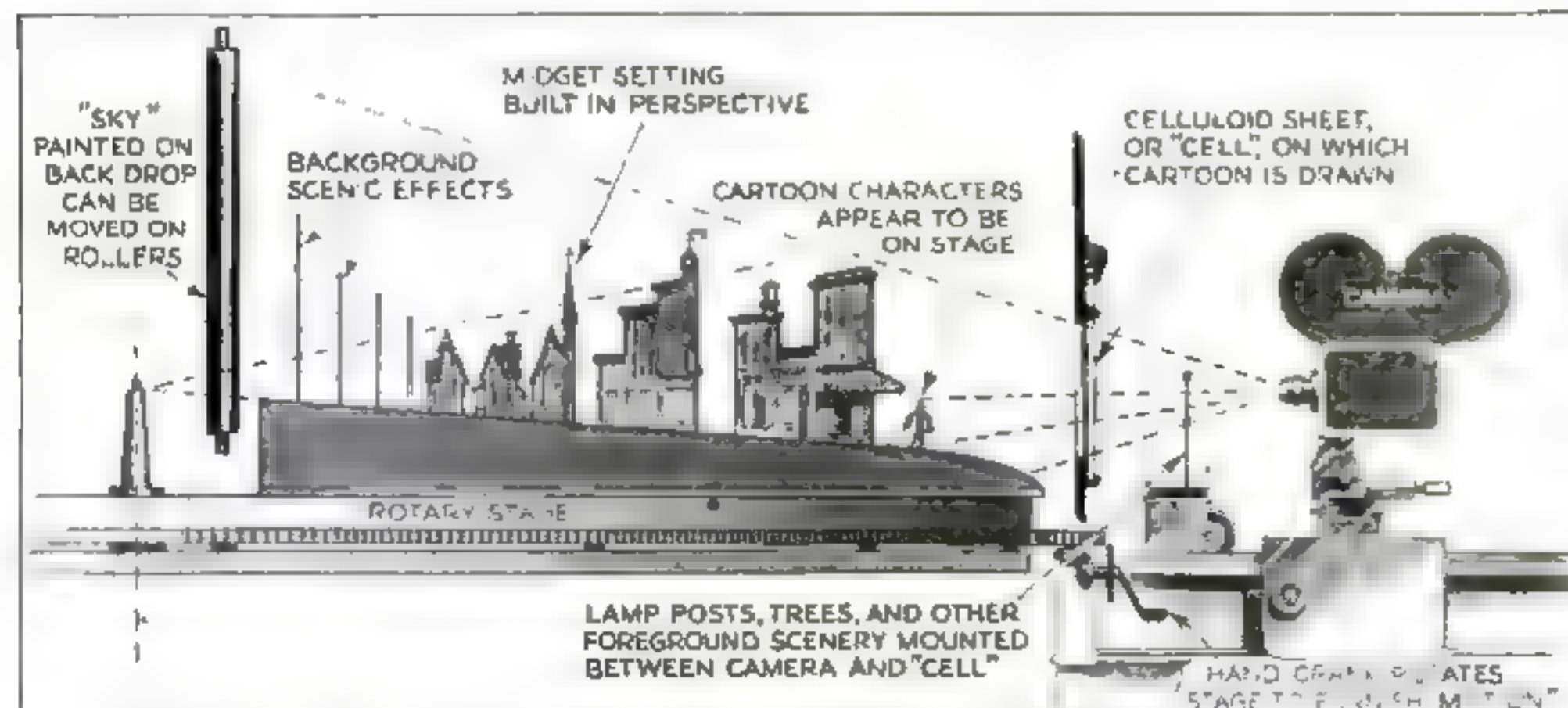
cardboard and carefully proportioned.

Backdrops behind the sets are mounted on vertical rollers. These rollers can be turned at any desired speed to give varying effects that range from summer clouds drifting lazily across the sky to storms rushing past at top speed.

If full-color films are being produced, the objects in the set can be painted to give the hues desired. Also, colored lights playing over the miniature building and landscapes can be employed to create spectacular effects such as moonlight and sunset scenes.

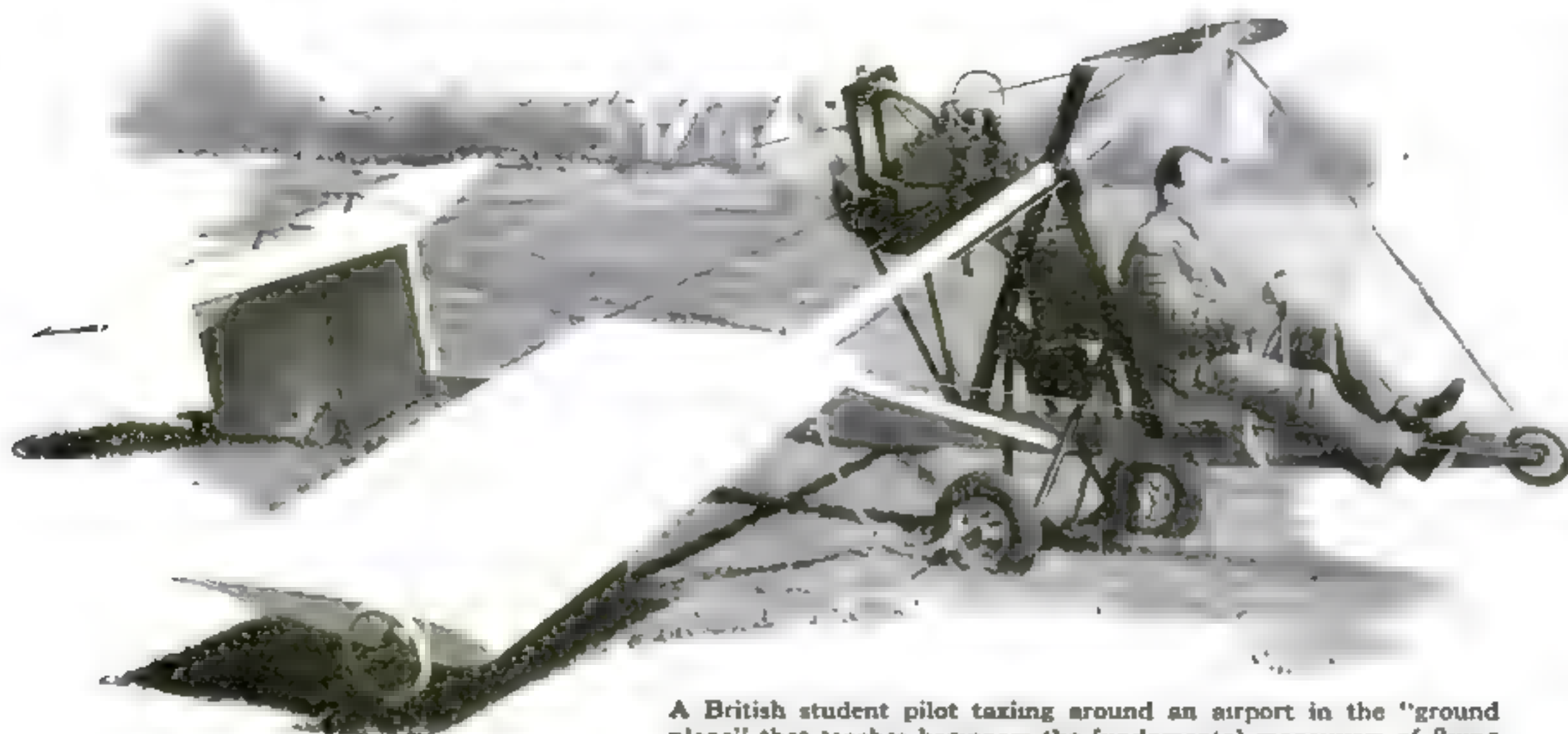
In addition to rotating, the table which holds the sets can tilt vertically. The impression of rising over a set in an airplane is achieved by tilting the table downward. In some mountain scenes, the set is tilted up to give the view from the valley and down to give the view from the peak. This permits using the same set throughout, and results in a saving of both time and money.

Several sets can be prepared on the rotating table at the same time. As soon as the filming of one set is completed, the table can be swung to the next. Max Fleischer, who has patented the new technique, predicts that similar methods may be applied on Hollywood sound stages in the production of feature pictures.



How the principles of perspective are applied in the construction of the settings to give the illusion of depth. The vanishing point, where parallel lines seem to meet, is at the table's axis





A British student pilot taxiing around an airport in the "ground plane" that teaches beginners the fundamental maneuvers of flying

ALTHOUGH it speeds along the ground at forty miles an hour, a curious airplane in service at a British field can never leave the earth. The wing-clipped machine is purposely designed with just too little lift to rise into the air, and is used for training student flyers. Since its controls have the same "feel" as those of a full-fledged plane, all the necessary maneuvers of flying may be learned without risk. A would-be pilot is required to spend six hours' time in taxiing the trainer about the airport before taking a standard craft aloft.

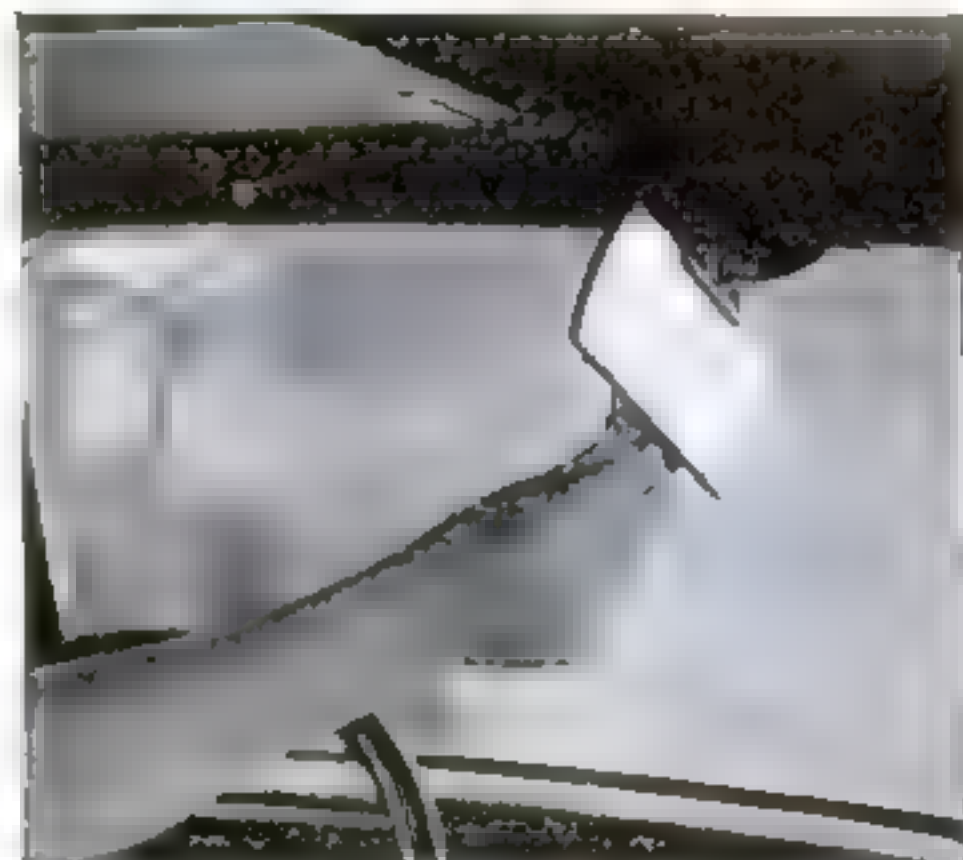
MEASURES REACTIONS TO LOUD NOISES

ARE you rattled by the insistent honking of a taxicab blocked by your car, or does the sudden blast of a truck's horn, as you are crossing a street, root you to the

spot in terror? How different persons vary in their reactions to loud sounds is now being studied with the aid of an "excitability meter" that recently was tried out upon a number of New York motorists. When electrodes are attached to the subject's hands and a startling noise is produced without warning, the effect on the subject is betrayed by a fluctuating needle on the dial of a nearby electric meter, providing a far more accurate way of gauging his emotional reaction than merely by observing whether he blinks or jumps. The instrument was designed for use in testing the fitness of subjects to drive an automobile.

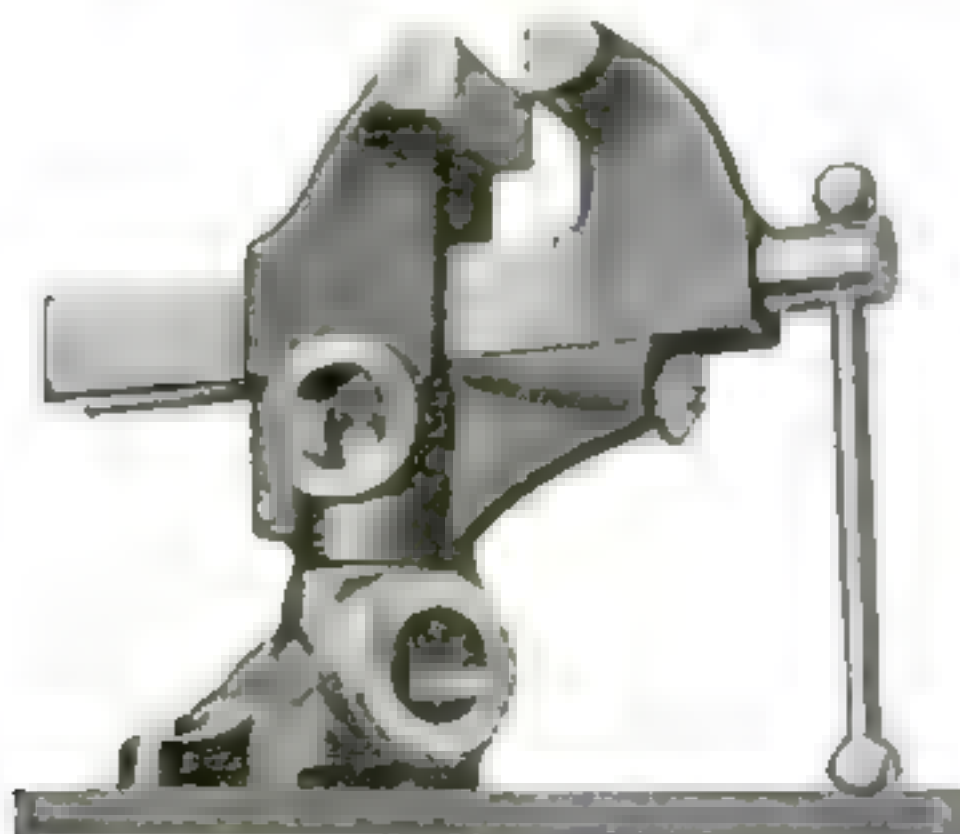


Testing a subject's reaction to startling sounds. The effect produced by a noise is indicated by a needle on the electric meter at the right



TWO-FACED AUTO MIRROR CUTS GLARE AT NIGHT

TWO-IN-ONE rear-view mirrors for day and night driving are now available to motorists. One side of the reflector is of ordinary clear glass for daytime use. Turning the mirror around on its swivel mount, as shown above, substitutes a glareproof face of dark glass that subdues headlights of cars approaching from the rear.

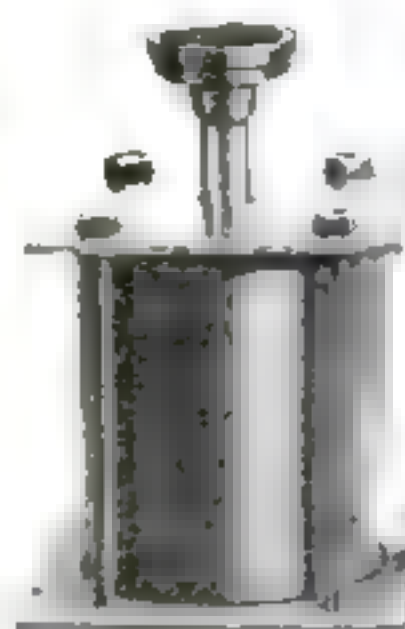


WISE CAN BE ADJUSTED TO ANY ANGLE DESIRED

QUICKLY adjusted to any angle in any of four different planes, a new bench vise for woodworkers and machinists, shown above, is locked in position automatically when the jaws are tightened upon the work. The vise may be mounted upright or sidewise, to swivel upon a tubular post set vertically or horizontally.

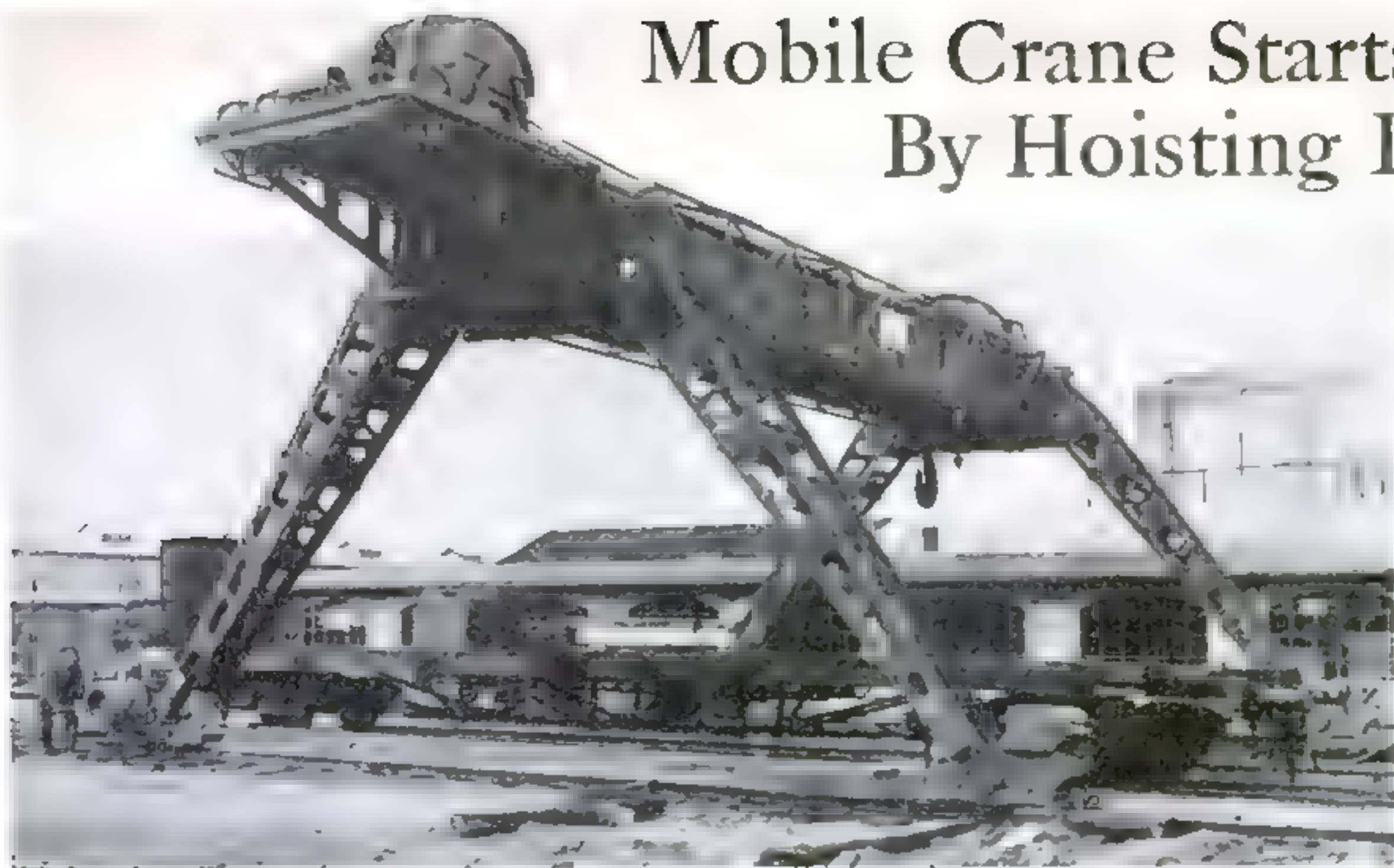
AIR FROM SPARE TIRE OPERATES NOVEL JACK

AIR PRESSURE from the spare tire operates a new auto jack, relieving the user of the manual labor of jacking up a car wheel, and making the task an easy one for a woman or child. When a tire needs changing, the jack is placed in position, a hose is slipped over the spare-tire valve, and the wheel is raised from the ground in only ten seconds. Plenty of air remains in the spare for road use, according to the Detroit, Mich., inventor; a tire containing thirty-five pounds pressure, used in a test, was found still to register thirty pounds pressure after the jacking operation had been completed. The jack is sturdy and simple in construction, having only one moving part.



A hose conducts air from the spare tire to jack seen at left

Mobile Crane Starts Each Job By Hoisting Itself

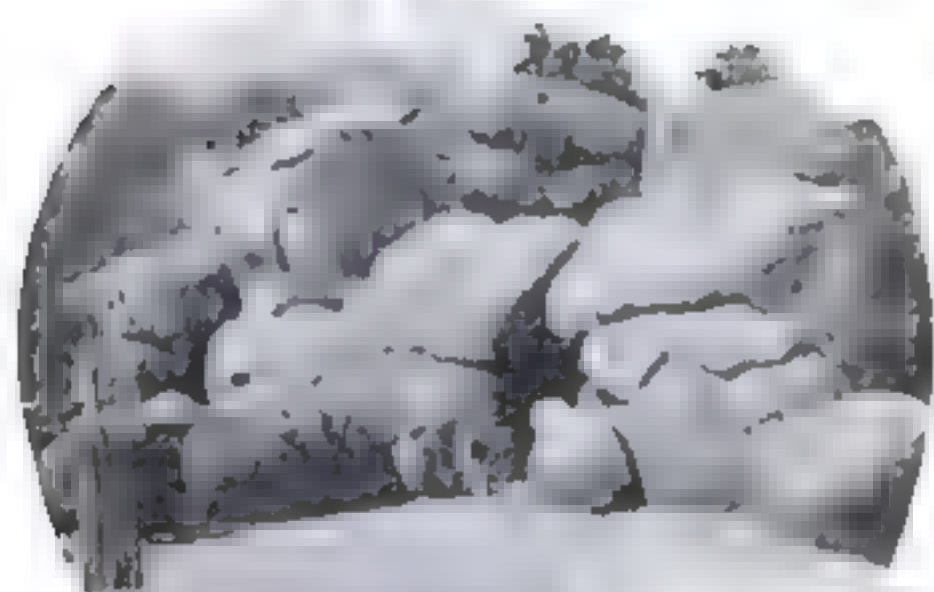


To raise the crane, each pair of legs is drawn together with hand winches and fastened with beams. Feet rest on tracks

WITHOUT recourse to special hoisting tackle, a portable crane developed in Germany can be transported easily and erected in only five hours, for it actually lifts itself into place when its hinged legs are drawn together with hand winches and fastened with connecting beams. Flanged wheels at the base of the legs ride on previously installed rails. Diesel-electric power operates the crane, which can lift 100 tons and may be shipped wherever it is needed, disassembled, on a pair of railroad flat cars.

MAN-MADE ROCKS FORM DENS FOR ZOO

ARTIFICIAL boulders provide a realistic setting for animals in the St. Louis, Mo., zoo. Made of a concrete mixture sprayed on with a cement gun, the man-made rocks conceal the brick cages and shelters. Forms for the improvised boulders were made from shaped steel rods covered with metal lath. To complete the effect, artificial lichens may be attached to the simulated rock. Unsightly bars and fences are replaced by wide moats to confine the animals to their outdoor yards.



A zebra photographed against a background of artificial boulders. Right, a brick shelter covered with forms of steel rods, ready to be faced with metal lath and sprayed with a concrete mixture to simulate rough stone



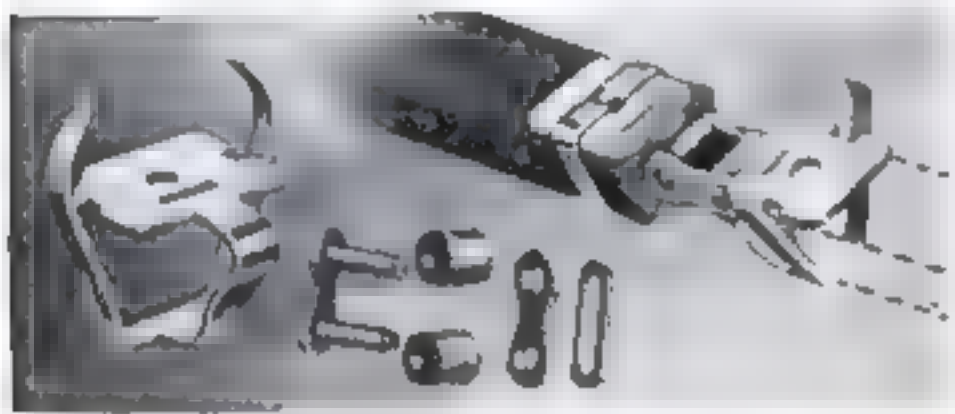
DARKROOM THERMOMETER IS ILLUMINATED

To aid in maintaining photographic developing fluids at proper temperatures, an illuminated thermometer has recently been introduced for darkroom use. A small, red-colored bulb, mounted at the top of the glass-enclosed thermometer, is wired or screwed into a standard flash-light socket. When in use, the red bulb casts a soft glow on the thermometer face, making it easy to read the mercury column and graduated scale of the instrument.

BUILD FLOAT FROM MODEL PLANS

FOLLOWING plans for a scale model of Columbus's flagship, published in *POPULAR SCIENCE MONTHLY*, the Santa Maria, Calif., Chamber of Commerce constructed the impressive float shown below. Mounted on a horse-drawn cart, the ship was given a place of honor in a recent parade.

The parade float below, representing the *Santa Maria*, was made by following ship-model plans from this publication



NEW V-BELT COUPLING HAS ROLLER BEARING

UNUSUAL strength is claimed for a new type of roller-bearing coupling for V-shaped machinery belts. Designed to run without lubrication, the coupling will operate effectively even over flat pulleys, and can be used to join either fabric or cord belts. Fitted with oversize bearings that permit a rocking action, the new coupling is said to last much longer than couplings which utilize tight-fitting bearings.

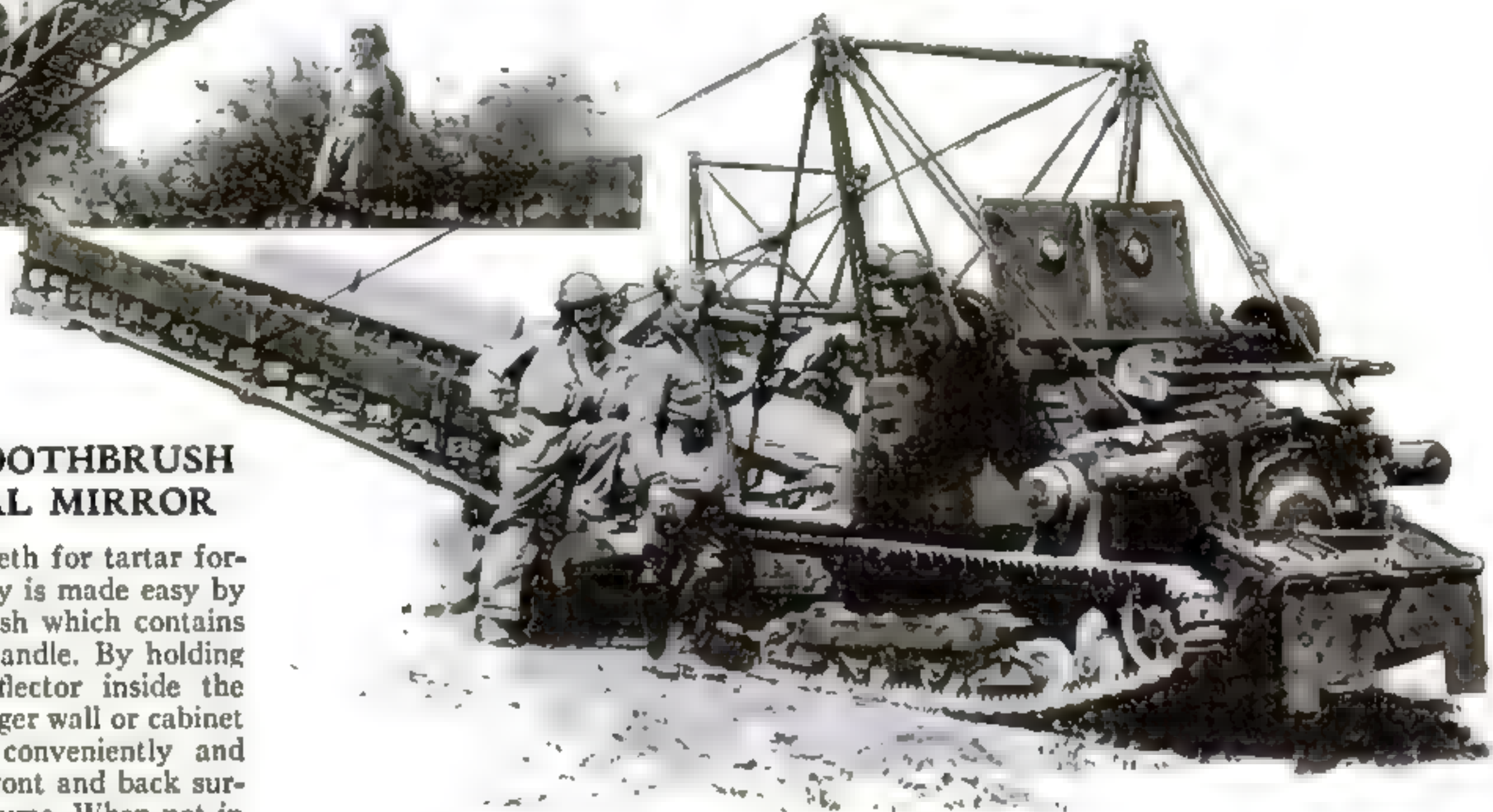




An Italian tank laying a portable bridge across a ravine. Right, the novel war machine with bridge raised for transportation

NEW WAR TANK BRIDGES STREAMS TO SPEED TROOP MOVEMENTS

A TANK tested in recent Italian war games carries a mobile bridge over which troops may cross small rivers and gullies. The portable span is hinged to the front of the tank, and wire cables raise it clear of the ground for overland transportation. When an advancing column reaches a ravine, the tank crew lowers the bridge over the gap, where it is anchored to the opposite bank by wedge-shaped spikes, and the soldiers march across with little delay. The equipment was specially designed for use in rough, hilly country.



HANDLE OF TOOTHBRUSH HOLDS DENTAL MIRROR

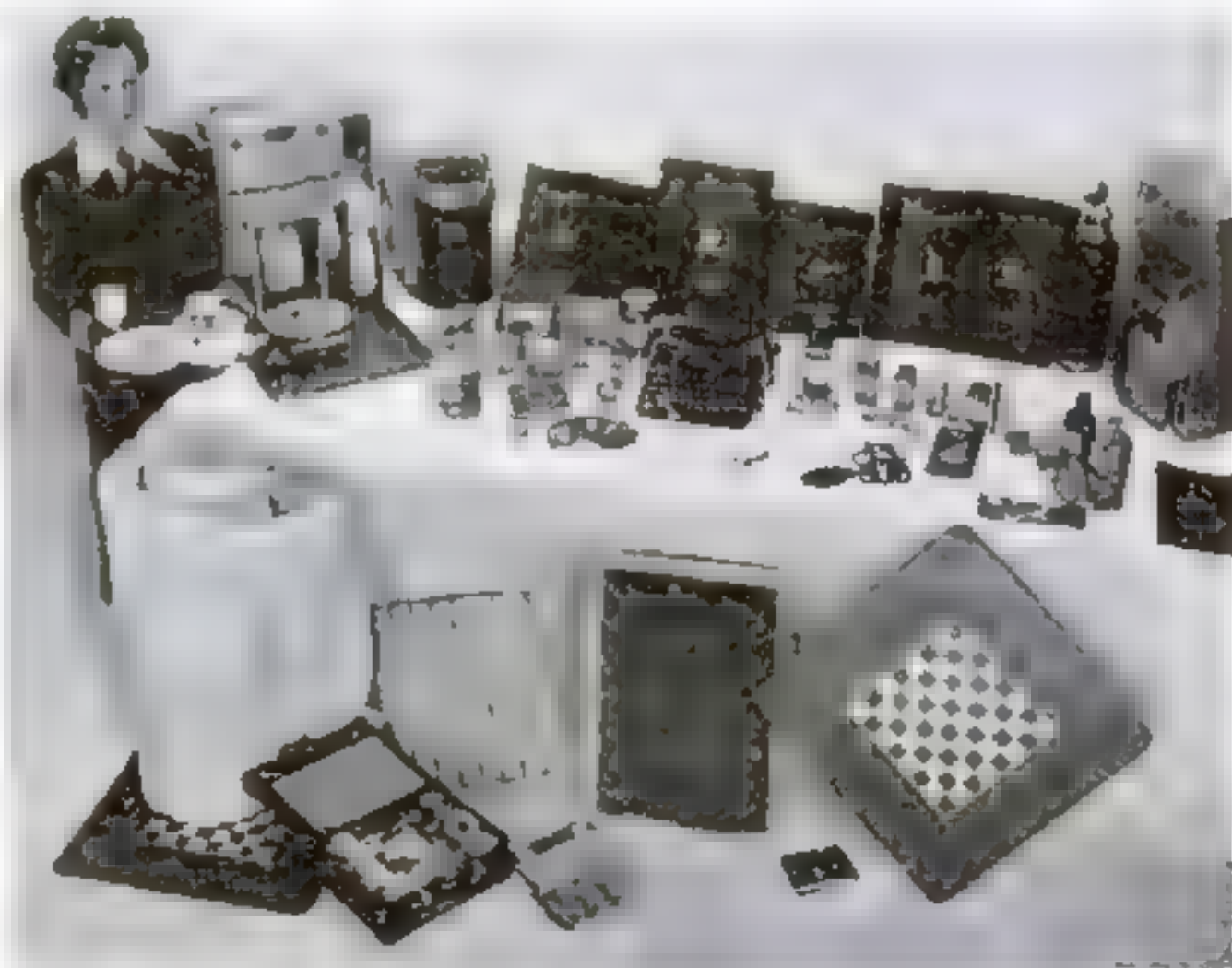
INSPECTION of the teeth for tartar formation or possible decay is made easy by a new type of toothbrush which contains a dental mirror in its handle. By holding the highly polished reflector inside the mouth while facing a larger wall or cabinet mirror, the user can conveniently and quickly examine both front and back surfaces of the teeth and gums. When not in use, the mirror slides into the handle, where it does not interfere with the ordinary function of the brush.



Dental mirror in use for examining back surfaces of teeth. It slides into the toothbrush handle

PLANES CARRY ALL COMFORTS FOR PATRONS

ALL the comforts of home are now provided for passengers on modern airliners. Acting the roles of housewife, secretary, and nurse, the plane stewardess draws on the extensive supplies shown in the photo, for the convenience and comfort of air travelers. The equipment includes a typewriter, electric razor, blankets, checkerboards, and vacuum bottles.



RADIO WAVES ARE USED TO DRY PLASTER WALLS

WET PLASTER walls in new houses are now quickly dried by ultra-short radio waves, according to a recent announcement by the Russian Institute of Industrial Construction. Placed inside a newly plastered room, a small transmitting unit similar to those used by doctors to furnish heat to joints or other internal parts of the body, radiates waves from two to fifteen meters long. The radio waves produce heat inside the plaster, and the walls dry out in a fraction of the usual time. Painting and other decorative work on the walls can then be started with little delay.



PROPELLER DRIVES NOVEL BICYCLE

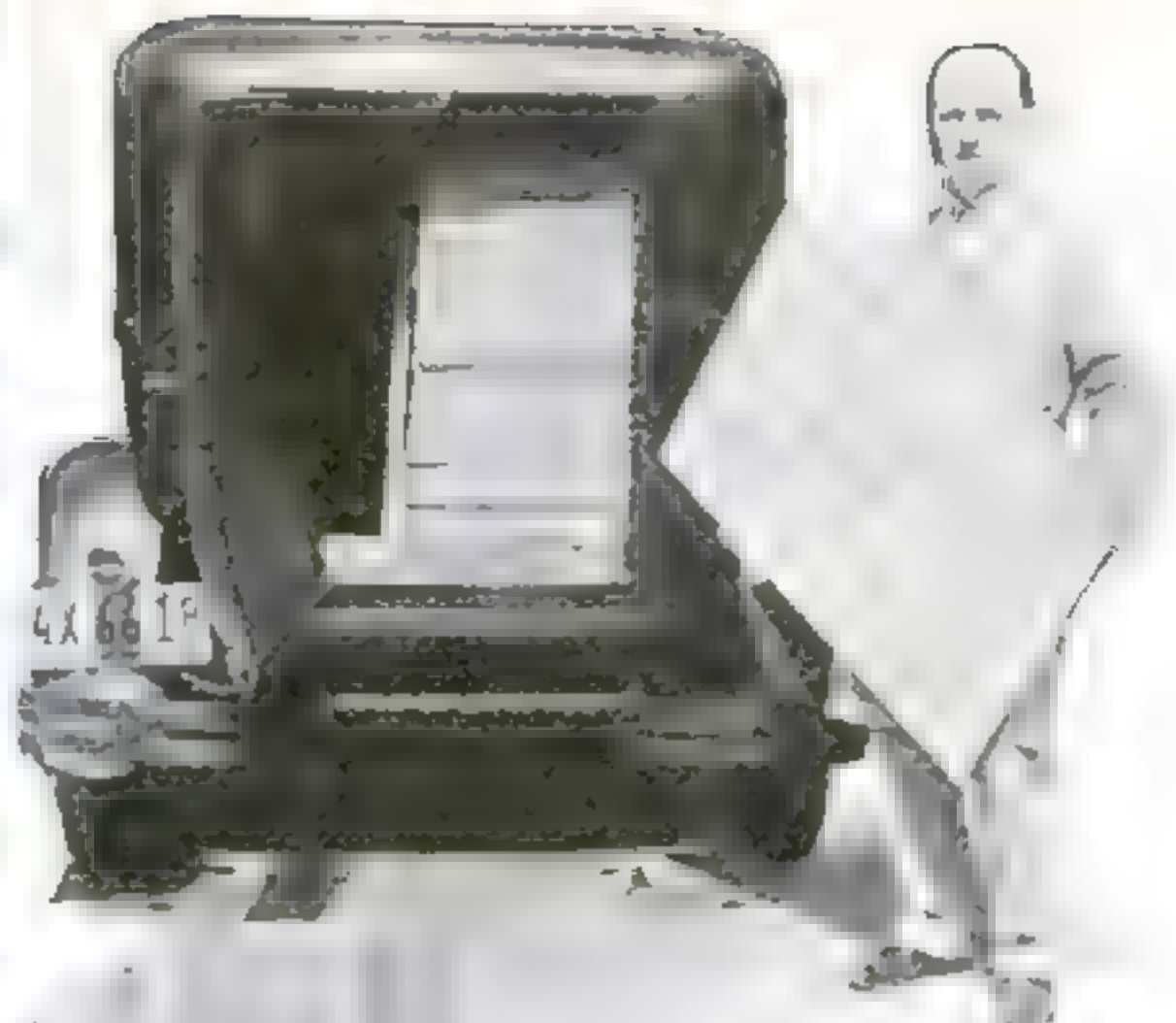
A WHIRLING, three-bladed propeller provides the motive power for a bicycle of odd design recently exhibited in Paris by a French inventor. Mounted at the front, the propeller is attached to a driving rod in a gear box supported over the front wheel by a metal frame. The gear mechanism is connected by a chain to the conventional bicycle sprocket wheel, which is pedaled in the usual manner. An extremely high gear ratio, it is said, enables the cyclist to drive the propeller at high speed. A hand lever is used to operate a rear-wheel brake, as in ordinary European bicycles.



PORTABLE FLOOR FOR DANCING CARRIED IN SMALL TRUCK

PUTTING a thousand square feet of dance floor in a small delivery truck is the accomplishment of an inventive Californian, whose feat is appreciated by Hollywood, Calif., hostesses. Less than an hour is required to install the portable floor

in a garden, street, house, or building. One side is finished for ballroom dancing; the other, for tap dancing. Ingenious fittings lock together the individual panels in a smooth surface that will not warp or buckle, even in damp night air.



One of the panels that make up the portable ballroom floor. The sections are locked together by means of a hook arrangement shown in the circle. In the photo at upper left, a specially designed clamp is being used to pull the panels together

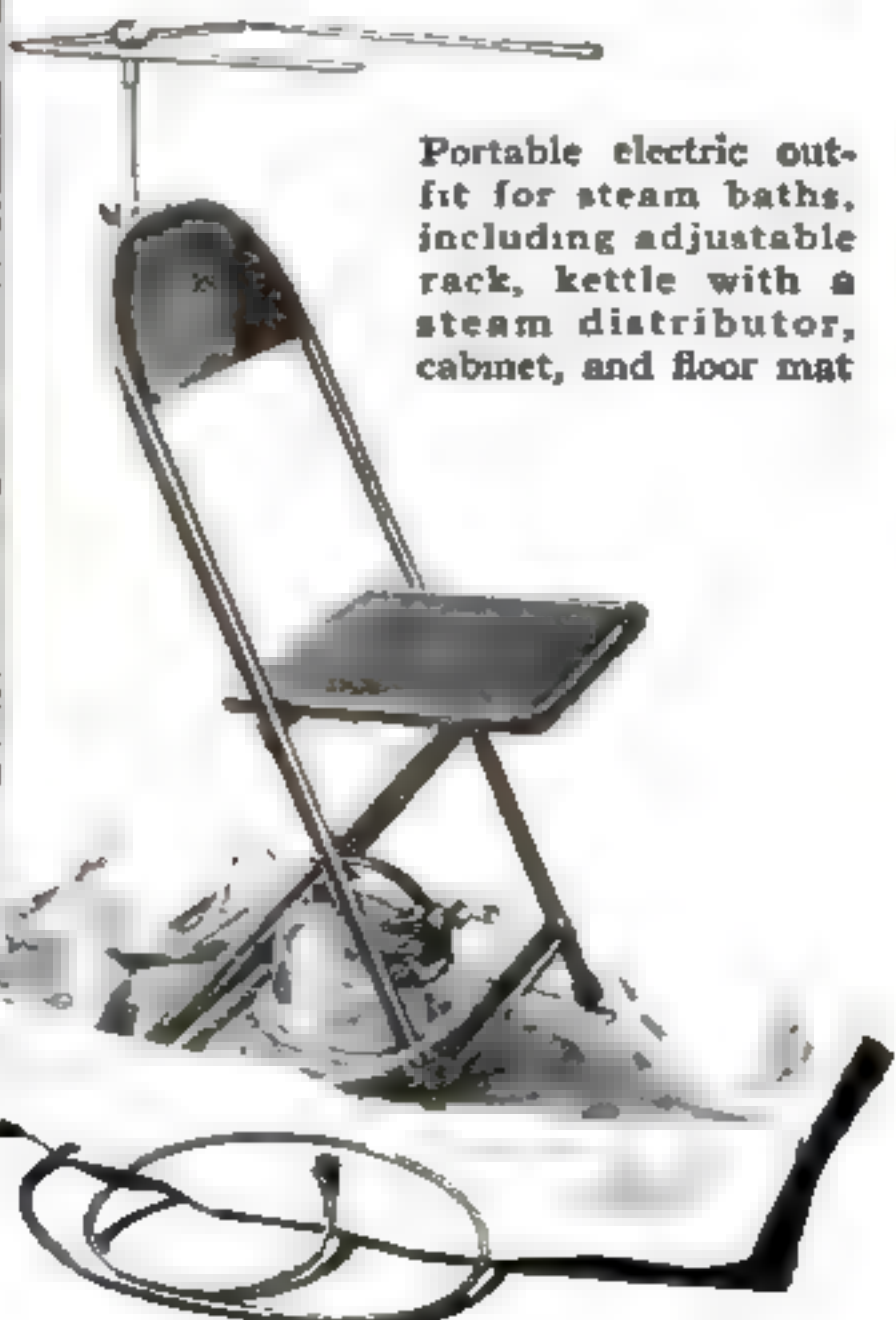
GIVES STEAM BATHS AT HOME

A STEAM bath at home, without need of an attendant, is made possible by a portable electric outfit now on the market. The equipment includes an aluminum kettle and

steam distributor, a chair with an adjustable support on the back, a cabinet of duck fabric, and a rubber floor mat. Quickly assembled, it is adaptable for any user from a small child to a large adult. Only five minutes is required to get up steam. The bather is in complete control of the apparatus and can turn the electric current on or off at any time, or open the curtain by pulling a slide fastener on the inside. The electric cord and switch are fully insulated to eliminate danger of shock.



Inside the cabinet, the bather can turn the current on or off, or open the curtain by pulling a slide fastener. The electric cord and switch are insulated



Portable electric outfit for steam baths, including adjustable rack, kettle with a steam distributor, cabinet, and floor mat



SCHOOLROOM CLASS TEACHES CHILDREN SAFE DRIVING

EVEN school children are now being taught the rules of safe driving, on the theory that it is never too soon to start fitting them for this motorized age. By the time they are old enough to operate cars, they are expected to be well grounded in the fundamentals of driving procedure. The illustration shows a driving class in session in a European school, where curves and crossings have been sketched upon a long linen ribbon representing a highway. With its aid, the pupils learn the technique of overtaking cars and of making turns, progressing from simple problems to difficult ones.

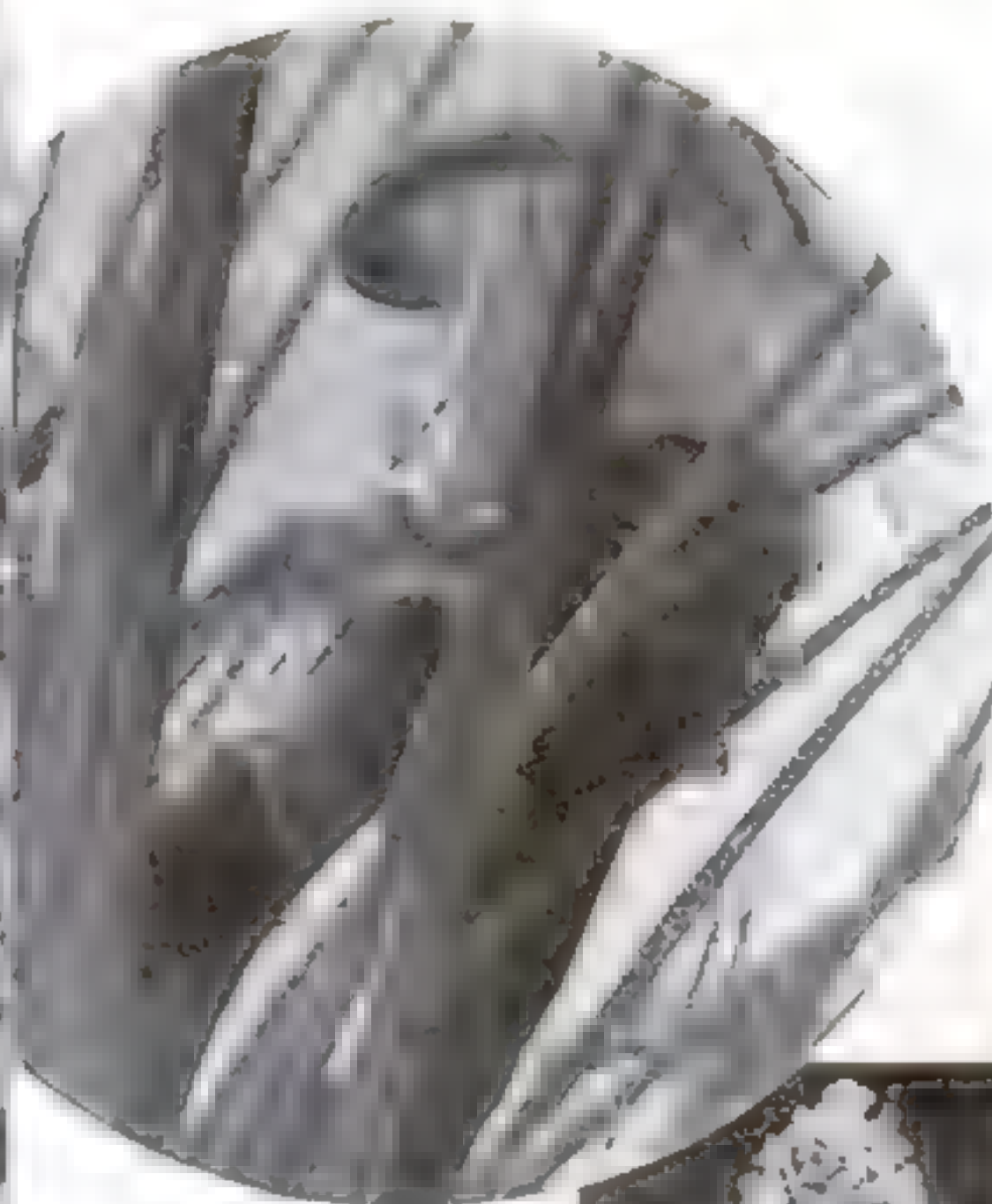
American Date Orchards

NATURALIZE AN ANCIENT FRUIT

By
**STERLING
GLEASON**



A picker harvesting dates in an American orchard. The extension ladder is mounted on a steel track that encircles the tree.



Men take the place of insects in fertilizing the date trees. Here a worker is tying pollen-soaked cotton inside a female bud.



Above is a female date blossom; at the left, a male. Only two or three male trees are needed to fertilize the forty-eight female trees in an acre.

A CRES of palms so tall they can be ascended only with the aid of ladders rivaling a fireman's aerial equipment.

Fruit so delicate it is put into bags before it is picked from the tree.

Harems of male and female plants, living in groups, each male surrounded by a score of females, like a Turk with his wives.

Trees that become taller with age, but not thicker.

Tiny buds growing in long clusters like beads on a string, painstakingly dusted by men who take the place of insects in the plant's life cycle.

These are some strange phases of modern date raising, one of the queerest forms of horticulture on earth. In ancient days, dates were a chance product—a miraculous gift of Nature to man in a blazing desert where no other food grew. Today, in the United States, they thrive in picturesque gardens where literally every date is raised by hand. High up on skyscraper trees, reached by wheeled extension ladders mounted on steel tracks encircling the trunks, grow clusters of golden fruit which reaches maturity only as the result of careful scientific attention.

Ever since Adam and Eve munched dates in the Garden of Eden, this delectable fruit has been one of man's choicest blessings. Ancient inscriptions show the tree was cultivated along the Euphrates, in Mesopotamia, 4,000 years ago. Egyptian scribes drew a single feathery palm leaf to stand for "month," and "year" was signified by a symbol picturing a crown of palm leaves. Throughout history, the date has been the staff of life to the bronzed, white-robed natives of northern Africa and Arabia. Yet the ancient industry is so young in America that of its 150,000-odd palms, two thirds are less than ten years of age and have not yet reached their prime. Equally new is the technique by which American growers scientifically propagate and cultivate the date—and harvest, grade, sterilize, and deliver it, sealed in transparent cartons, to your table.

How the fruited palm was brought from its native habitat on the burning African desert and developed into a producer of one of man's pleasantest foods, is a story of patient scientific effort spanning half a century.

Not until the middle of the nineteenth

century did the secret of date culture begin to penetrate to America. Then Gen. Charles P. Stone, traveling in Egypt, sent a few shoots of date palms to southern California. But his gift was not appreciated, and the delicate young plants withered and died.

At last, in 1898, government botanists at the University of Arizona Experiment Station determined to "naturalize" *Phoenix dactylifera* and adapt it to American soil. Dr. Walter T. Swingle, crack botanist of the U. S. Department of Agriculture, went to the Algerian coast in search of good specimens. Nine miles south of Biskra, on the edges of the great sink Chott Melrigh, a vast depression in the desert sinking nearly a hundred feet below sea level, he found huge gardens where grew the date tree known as Deglet Noor, or "Date of Light."

Pruning suckers from about the bases of healthy trees, Dr. Swingle wrapped them well in fibrous, hairy material from

the base of the date-leaf stalks, tied them into bags to be slung across the saddles of camels, and set off with his caravan toward the nearest outpost of civilization. Here he doused the shoots liberally with water, labeled them, and placed them aboard a specially chartered freight car billed for Algiers, 390 miles away. After much experiment, he devised a suitable method of packing them for their long ocean voyage. Crammed with moss packed around the shoots, the containers as shipped weighed from one to three tons each. A total of 447 offshoots thus finally reached the United States.

Then began a long series of experiments by which the baby trees were carefully nurtured until their character was established and the thousand or more varieties known to the Arabs had been culled down to a dozen choice kinds suited to American climate and soils. As inked needles traced their records, day by day upon the revolving drums of thermographs, hygrometers, and other weather-recording instruments, scientists studied the growth of the young buds and minutely charted the habits of the palm. In greenhouses chilled by refrigerating machines, they exposed young shoots to freezing temperatures. They bathed them with light from powerful mercury-vapor lights, then immersed them in total darkness.

They actually measured the almost imperceptible up-push exerted by the delicate growing leaves, clocking growth as slight as half a millimeter a day. They learned how the palms work nights and sleep days, their growth checked at dawn by some strange power of the sun's shortest rays. They found that the plants hibernate, bearlike, when the thermometer drops below forty-six degrees F., but waken when touched by the stimulating rays of the desert sun. And, by relentless elimination of the unfit, they propagated a superior race of date palms, which could

grow in the hot, irrigated areas of the Coachella and Imperial Valleys in California and the Salt River Valley of Arizona.

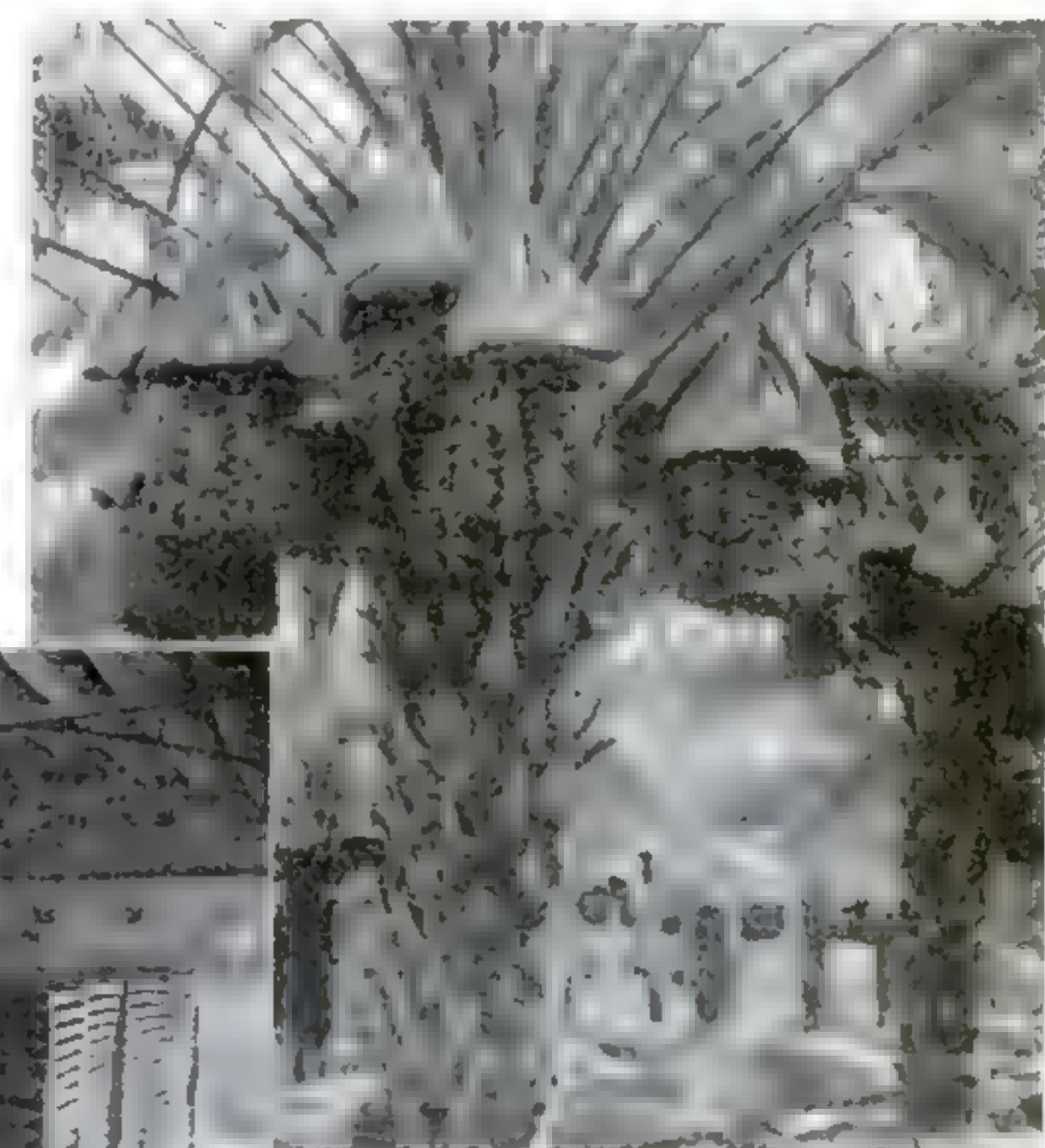
When I visited America's date paradise to learn how these scientists had built an amazing new industry, I saw on every hand the results of their two score years of patient work. The once barren sands of this below-sea-level desert were transformed into an oriental garden of graceful trees whose lacy fronds made a welcome protection against the blazing sunshine beating down from above.

"The date palm must have its feet in the water, its head in the sunshine," says an old Arab proverb, and here the ancient recipe was well fulfilled. Checkered by miniature sandy dikes dividing the fields into small squares for irrigation, the parts of gardens were undergoing the flooding which must take place once every ten days.

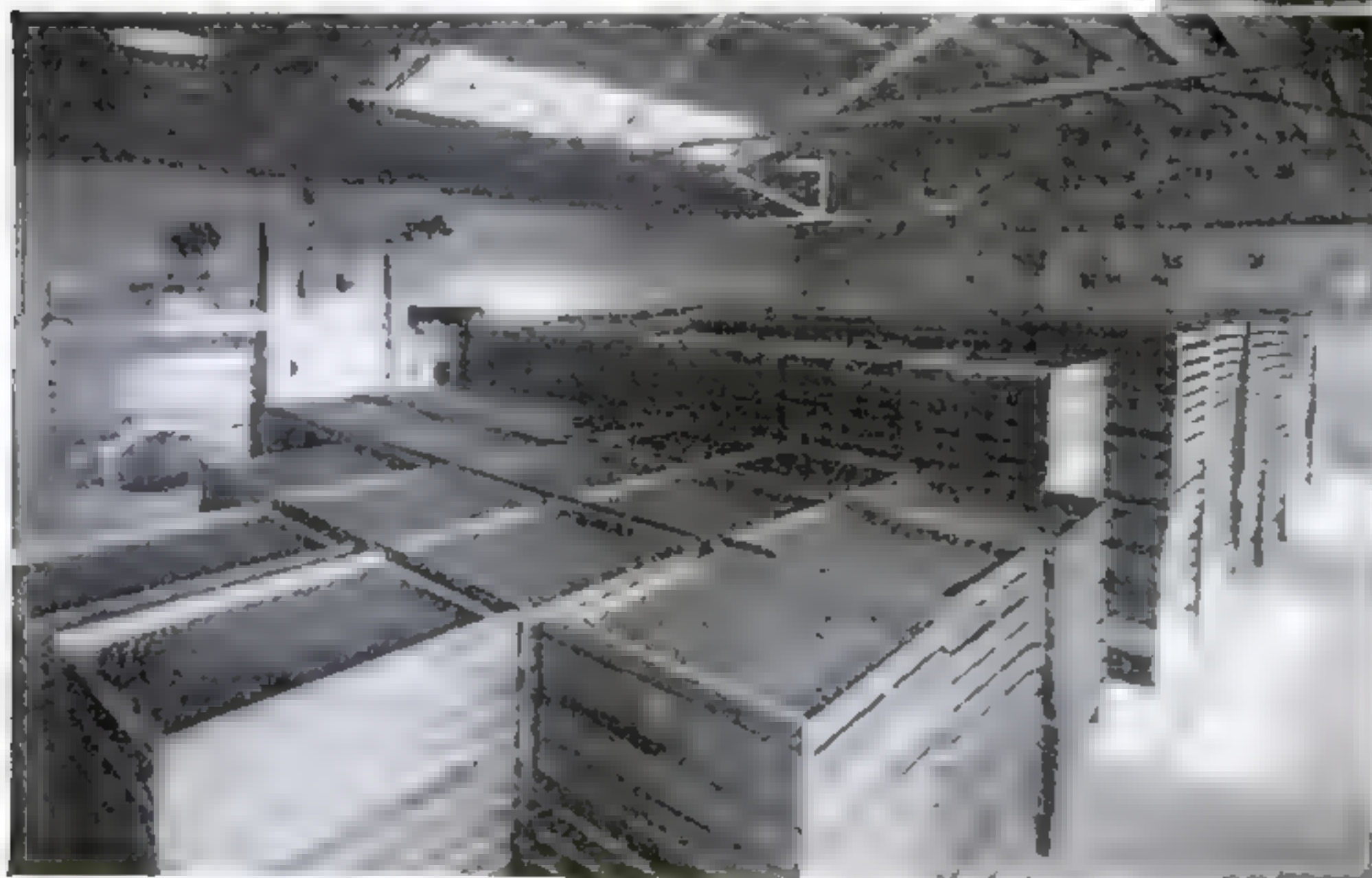
At once I learned a strange fact about the life of the date palm. These symmetrically planted groves consisted almost entirely



Ripe dates hanging in clusters on the tree. Every year, the tree grows taller and the fruit is borne higher above ground



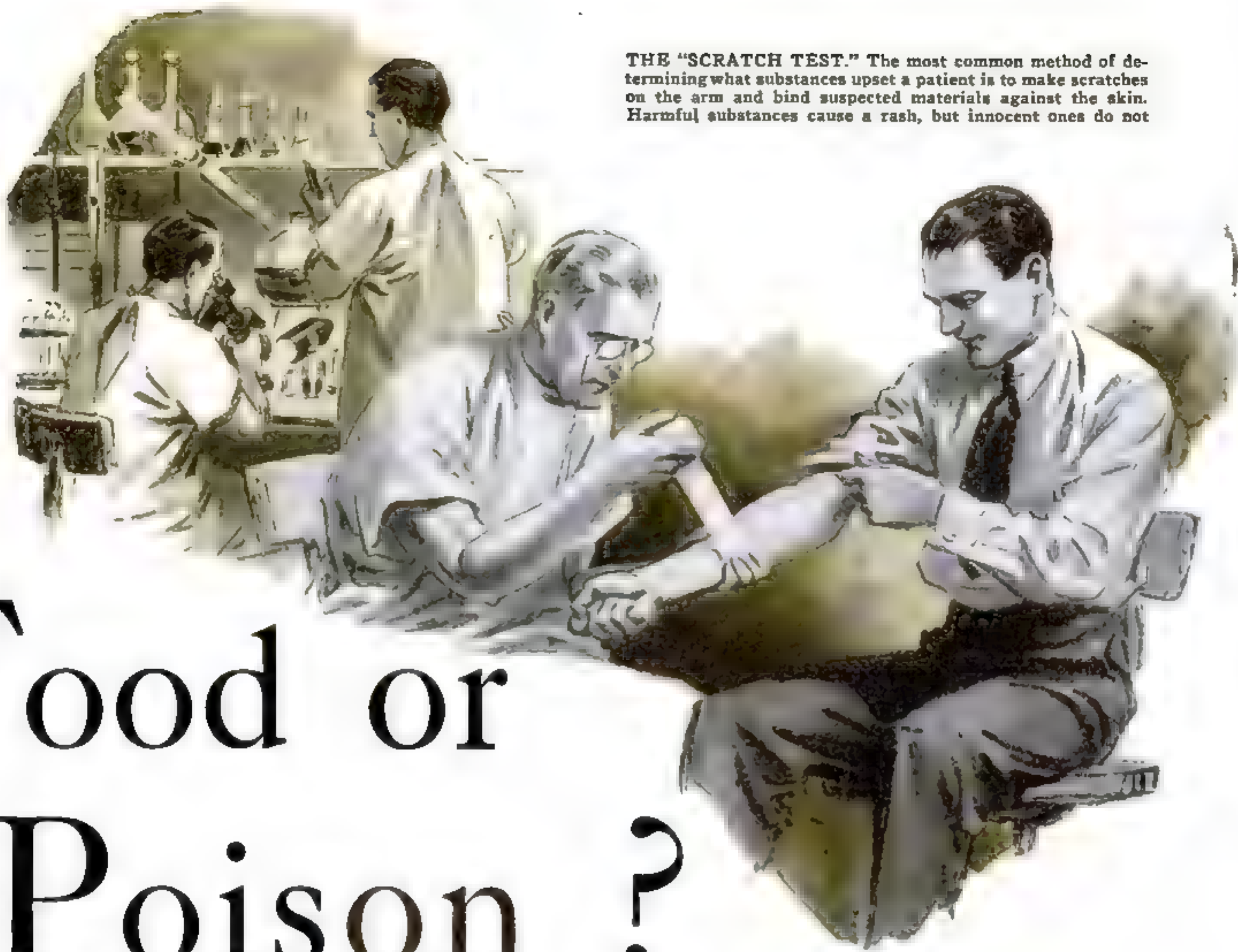
Date palms with waterproof bags rolled up from the clusters. These are lowered when it rains



In humidity chambers like this, moisture is added or taken away to give the fruit the right proportion of water. The wooden trays contain tons of dates

of female trees, only two or three males among the forty-eight trees on each acre being enough to fertilize the rest. The male palm bears no fruit, but its blossoms are heavy with powdery yellow pollen. Although bees and other insects are attracted to the male blossoms, they do not visit the female flowers; hence, their aid cannot be enlisted for the pollination, which must be done by hand. The mature blossoms are cut off, dried, opened, and the pollen shaken off, to be collected on small bunches of cotton. One large male blossom will yield about half a teacup of pollen—enough *(Continued on page 119)*

In Picturesque Groves on the Deserts of the West, Scientific Methods of Cultivation Produce a Food Transplanted from the Shady Oases of the Near East



THE "SCRATCH TEST." The most common method of determining what substances upset a patient is to make scratches on the arm and bind suspected materials against the skin. Harmful substances cause a rash, but innocent ones do not.

Food or Poison?

... STRANGE PRANKS OF A MEDICAL MYSTERY

OT long ago, a man arrived at the famous Mayo Clinic, at Rochester, Minn. This was his curious story: Every morning at eleven o'clock, no matter whether he was in a business conference or driving his car, he dropped asleep!

Dr. Walter Alvarez, of the clinic, followed clew after clew. Finally, he traced the ailment back to the man's breakfast, to his cup of coffee, and even to the cream in his morning beverage. When the patient eliminated cream from his coffee, the trouble disappeared!

Just as amazing are thousands of other instances of that strange and often fantastic disorder known as allergy. Victims are upset when they eat, breathe, or touch substances which are harmless to the average person. Literally, what is meat for millions is poison for them.

If eggs make you break out in a rash, if strawberries give you hives, if cats set you sneezing, you are allergic. Between 10,000,000 and 15,000,000 Americans, it is estimated, are allergic to something.

Every time a boy who lives in Brooklyn, N. Y., chews gum, he starts to cough and sneeze. He is sensitive to chicle. Every time a girl in Chicago, Ill., smells chrysanthemums, her eyes puff up. She is allergic to the flower's pollen. Every time a man in the South puts catchup on his steak, he chokes and gasps for breath.

He is affected by tomatoes in any form. Every time a woman in St. Louis, Mo., eats an onion, she gets blue spots on her skin. Every time—but the list goes on indefinitely.

I have known people allergic to such familiar things as wall paper, Christmas trees, sauerkraut, rubber, red plums, seed corn, asters, rice, dates, ginger ale, fly-specks, corn silk. I have heard of a butcher allergic to mutton; a florist sensitive to primroses; a carpenter affected by wood dust. And medical research is continually adding new trouble makers to the list.

At a recent meeting of the American Medical Association, the noted Kansas City, Mo., specialist, Dr. William W. Duke, reported a case of "scratch allergy." The patient was hypersensitive to mechanical irritation. Even a scratch might prove fatal, not from infection but from the shock of the tiny injury.

Some months ago, a physician friend of mine discovered what he thought was "aunt allergy." Each time a particular aunt visited a six-year-old child, the boy broke out in a rash resembling measles!

In the end, however, the doctor discovered that the youngster was violently allergic to eggs. The aunt invariably had bacon and eggs for breakfast and when she kissed her nephew traces remaining on her lips were sufficient to upset him!

Even more astonishing cases are familiar to medical men. Several patients have proved so sensitive to eggs that meat from a hen caused them to break out in a rash while meat from a rooster gave them no trouble. Infinitesimal traces of egg in the hen's meat were responsible. Likewise, meat from a cow may upset a patient violently allergic to milk, while beef from a steer proves harmless.

So sensitive was one patient to buckwheat that a single drop of honey made by bees after visiting buckwheat flowers would produce severe abdominal pains.



CREAM in his breakfast cup of coffee caused a business man to fall asleep promptly at eleven o'clock every morning, even if he was in a conference or driving his car along the road.

It was not the sugar content of the honey that caused the trouble. It was the remnants of buckwheat. In the laboratory, if you remove the water and sugar from honey by dialysis, or the use of special membranes, virtually nothing remains behind. Yet, it was this "nothing" which brought on the attack!

When a physician encounters an allergic patient, his work more than ever resembles that of a detective. He hunts clues; he eliminates suspects; he traces effect back to cause. The commonest method of tracking down an outlaw substance is known as the "scratch test." How it works is illustrated by a mystifying case reported from the Middle West.

One day, an elderly man licked the flap of an envelope in sealing a letter. A few minutes later, he began to tingle from head to foot. Then, his face grew purple, his breath came in gasps, and he dropped to the floor, unconscious. It was fifteen minutes before he came to. But in half an hour he was as well as ever. On another occasion, he tried on a pair of shoes that had just come back from the cobbler's. Hardly could he tear them from his feet before he fainted. What was the secret of the strange attacks?

His physician suspected that the root of the trouble was allergy. Making tiny scratches on the patient's arm, he bound various substances tightly against the skin. In this test, harmless substances produce no effect; harmful ones cause a rash on



CATS have a strange effect on some people. The mere presence of one of the animals in the same room will set such a sufferer off into a violent fit of sneezing that may last for hours

allergic to twenty-eight different things. She suffered from hay fever, asthma, hives, and a constantly upset stomach, all caused by the everyday substances that were poison to her system. They included potatoes, eggs, salmon, cod fish, mustard, green peppers, black pepper, chicken feathers, cattle hair, ragweed pollen, cockle-burs, and aspirin.

Recently, the famous Richmond, Va., allergist, Dr. Warren T. Vaughan, announced a new and more sensitive test for foods that cause trouble, based on the pio-

the skin or react in some other way. Almost the instant that fish glue touched his arm, the patient started, and began to gasp for breath. This glue was a violent poison to his system and he had encountered it on both the insoles of the shoes and the flap of the envelope.

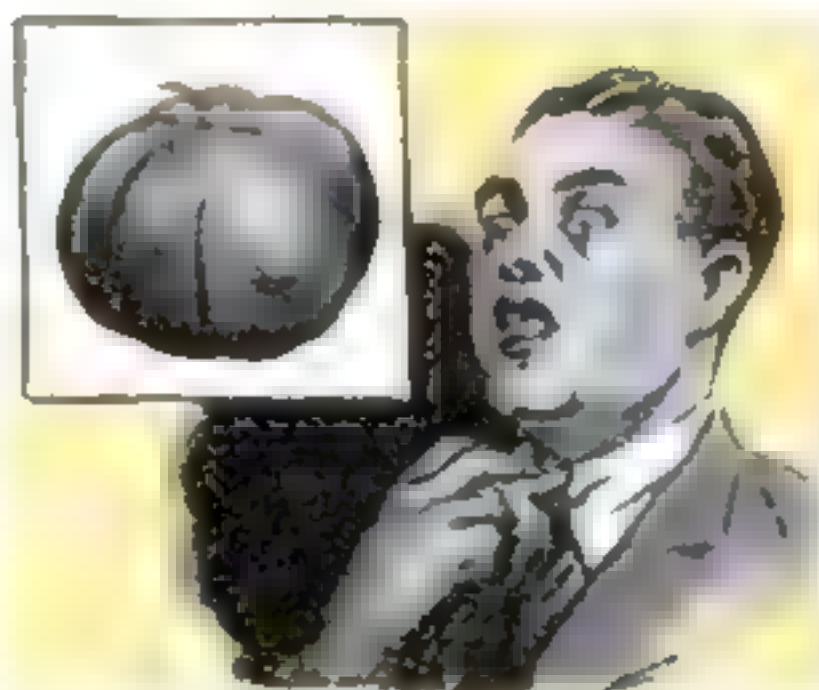
By means of the scratch test, one doctor found that an unfortunate four-year-old child was

neer work of the French scientist, Dr. F. Widal. After a twelve-hour fast, the patient dines on the suspected food. Then, blood samples, taken at half-hour intervals, go under the microscope. If the food is the trouble maker, there will be a noticeable decrease in the number of white corpuscles in the blood.

Only a few weeks after the new test was made public, it gave dramatic proof of its value. For eight years, a patient had been confined in a middle western sanitarium with a persistent fever. Doctors diagnosed her condition as tuberculosis. Using the Vaughan test, a physician proved that she was suffering from allergy and was continually being upset by the very foods she was being fed to make her well! When these foods were eliminated, the fever subsided and she was able to leave the sanitarium where she had spent nearly a decade.

Strangely enough, it is often the most wholesome foods that cause the most trouble. Eggs, wheat, and milk are, in that order, first on the list of trouble makers. Also, the allergy victim rarely dislikes the food that makes him sick—and oftentimes it is his favorite dish!

If you ask a specialist to explain just what such a food does in the system, he will be hard put to answer. Someone once (Continued on page 127)



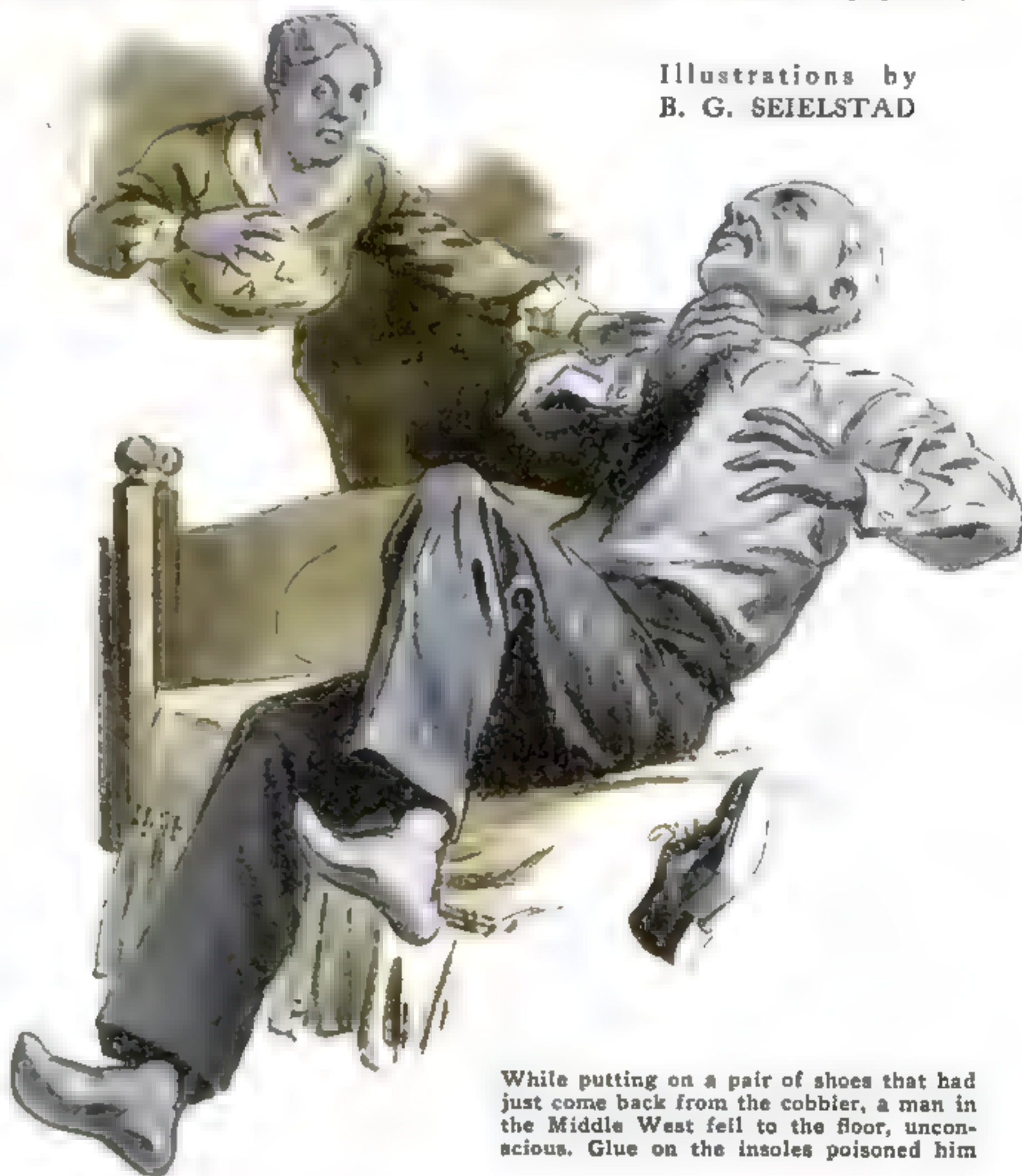
TOMATOES are so deadly to a certain southerner that if he puts catchup on his steak he immediately chokes and starts gasping for breath

Physicians Must Turn Detectives To Find the Causes of Ailments Produced by Eating, Breathing, Or Touching Common Substances

By
FREDERIC DAMRAU, M. D.



CHRYSANTHEMUMS are not a welcome gift to one Chicago girl. She is sensitive to their pollen, and when she smells them her eyes puff up



While putting on a pair of shoes that had just come back from the cobbler, a man in the Middle West fell to the floor, unconscious. Glue on the insoles poisoned him

Illustrations by
B. G. SEIELSTAD

Amateur

AT THE National Museum, in Washington, D. C., not long ago, Dr. Charles E. Resser, eminent paleontologist, was opening his morning mail.

Unwrapping a small bundle, he discovered a slab of stone hardly larger than his hand. It contained what appeared to be a trilobite, one of the fossil ancestors of the horseshoe crab. A second glance, however, told Dr. Resser it was a new and dramatic find, a prehistoric crustacean hitherto unknown to science.

The fossil had been picked up in a small canyon of the House Mountains and had come from a man named Frank Beckwith, of Delta, Utah. In all likelihood, Beckwith's name never would have been known outside the small circle of his acquaintances except for his part in this discovery. Now it is familiar to scientists around the world. Future textbooks will refer to the fossil creature as a "Beckwithia"; museums will exhibit specimens labeled "Beckwithia"; new species of the order will be designated "Beckwithia," with another name after it to distinguish it from the others. Thus, the National Museum has immortalized the help of an amateur.

If you leaf through the records of almost any field of research, you will find scores of similar instances; cases in which some amateur archaeologist, some spare-time explorer, some alert traveler, some rider of a scientific hobby, has discovered something worth while and has aided the advance of knowledge. Amateurs are the scouts of science, pointing the way for the new advances.

Hewing through the jungles of Yucatan or crunching over the snow wastes of the antarctic is the average man's idea of exploring. He rarely thinks of his own neighborhood as a field of research. Yet, the expedition to a far-away land can stay but a limited time, while the amateur explorer, working at home, can devote a lifetime to his useful hobby. He can become an undisputed authority on the birds, animals, minerals, insects, Indian relics, or fossils of his locality. And always there is the thrilling possibility that he is skirting the borders of a great adventure, the discovery of something new.

One fall day, two years ago, an amateur collector of butterflies, C. N. Rudkin, slammed on the brakes and slid his car to a stop on a winding mountain road near his home in California. Hovering over a moist spot ahead were a half dozen brilliant black-and-yellow butterflies. Like a



A member of the Alpine Club of Canada climbing a cliff in Jasper National Park. Right, students of the University of Nebraska unearthing the remains of a large prehistoric city discovered near Lynch, Neb., by a local school superintendent



By ROBERT E. MARTIN

*Serving as the Advance Guard of Science,
Enthusiastic Hobbyists Are Adding Pages
To Our Knowledge of the World We Live In*

Explorers

MAKE AMAZING NEW DISCOVERIES

big-game hunter stalking animals at a water hole, Rudkin crept forward, his net ready. A few deft swoops, and he had captured several specimens. To his amazement, he found they were unknown to entomology. Within the boundaries of his own horizon, he had made a find such as men travel thousands of miles on costly expeditions to obtain. In honor of the amateur who discovered it, the new butterfly has been christened "Papilio rudkini," or Rudkin's swallowtail.

Another amateur, in the same state, was tramping among the Trinity Mountains when his eye was attracted by a delicate white flower edged with pink. He had never seen anything like it before. Carefully, he dug up the plant and carried it to a professional botanist who proclaimed it a brand-new species of *Lewisia*, or bitterroot. Like the butterfly and the prehistoric fossil, the plant has been named in honor of its finder. It is known to botany as the "Lewisia hackneri."

Almost every day in the year, amateurs forward specimens to museums for study and identification. Such institutions are always ready to assist the home explorer who is doing original work. Frequently, the debt is repaid by some valuable addition to public collections made by such workers.

Not long ago, for instance, Dr. Chester A. Reeds, Curator of Geology at the American Museum of Natural History, in New York City, received a tiny package from a man in Tennessee. It contained fossil seeds from a tree of the Carboniferous age and proved an interesting addition to the relics of this lush era when the world's supply of coal was being formed.

Workers who have out-of-doors occupa-

THEIR HOBBIES HELP SCIENCE

A part of the large collection of fossils gathered by Dr. Asbjorn P. Ousdal, of Santa Barbara, Calif., on the nearby seacoast and mountains. Below, specimens of a kind of cactus that was unknown to botany until discovered by a Colorado amateur.



tions or hobbies appear to have the best chance of discovering something new. Hunters, surveyors, ranchers, farmers, railroad men—all have contributed valuable finds to science.

It was a Colorado judge, C. C. Coffin,

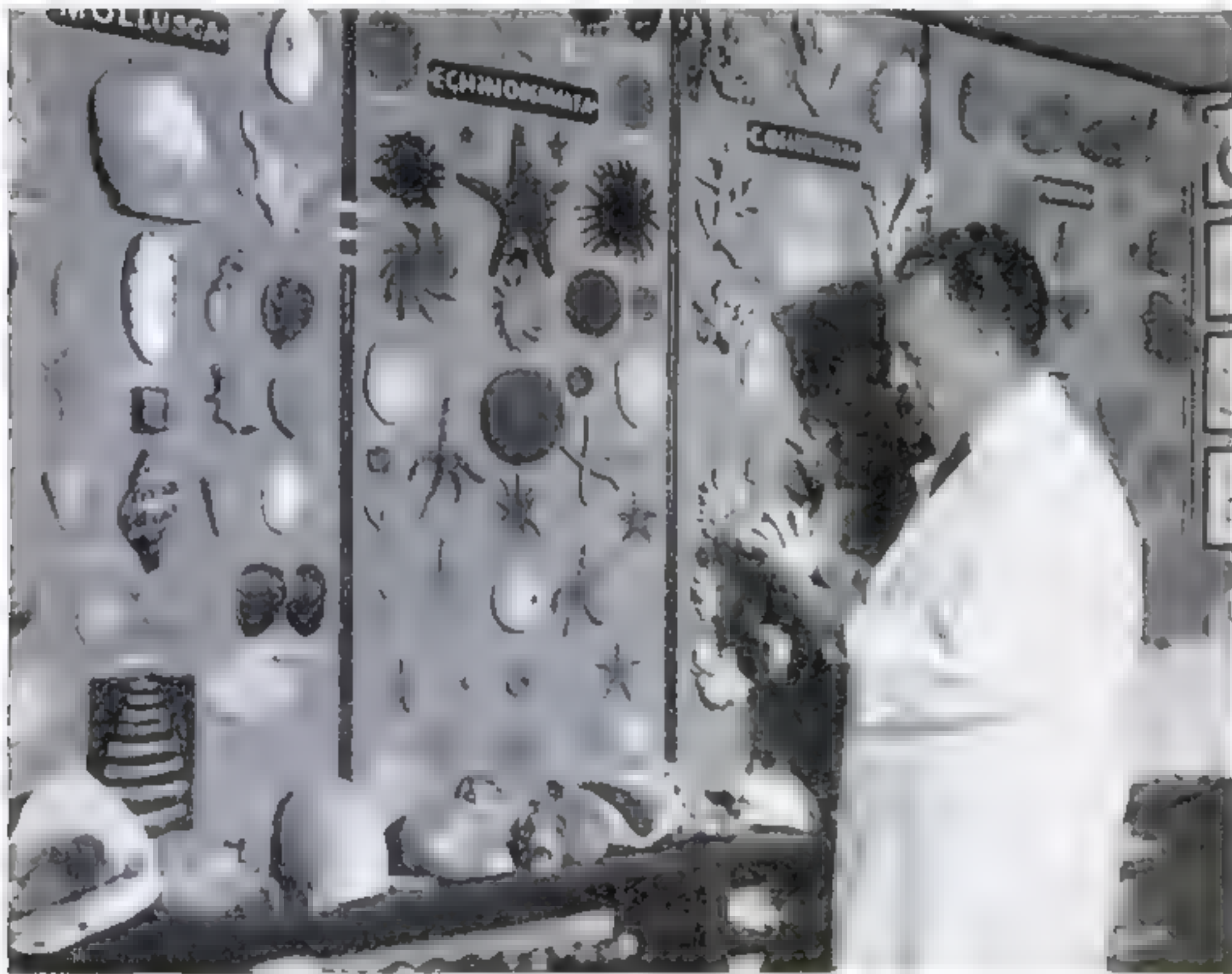
hunting rabbits with his son in the foothills north of Fort Collins, who stumbled upon a strange stone javelin head unlike the Indian relics of the region. That chance discovery led to one of the most important archaeological finds in America. A Denver anthropologist examined the stone weapon. He pronounced it a relic of the "Folsom man," a race that inhabited North America more than 10,000 years ago.

Further search disclosed similar weapons. In 1934, under the direction of Dr. Frank H. H. Roberts, an expedition started work at the site. Fourteen feet below the surface, the diggers uncovered the remains of a prehistoric camp. Buried with the bones of extinct animals were javelin points, scrapers, drills, and the crude ornaments with which these first Americans adorned themselves.

The Judge's rabbit hunt had ended by giving science its clearest picture of the culture of this bygone race. Another hunting trip, along the bank of a canal on the western coast of Florida, gave science an ice-age monster.

Walter Holmes, a retired business man from Waterbury, Conn., was walking along the canal not far from his home in St. Petersburg when he espied some curious fragments of bone. They turned out to be the scutes, or horny plates, of a glyptodont, an armadillo-like creature of the Pleistocene age. Renting the adjoining property for excavation, Holmes started a one-man expedition to look for fossils. The result of his digging has been a fine collection, adding to the world's knowledge of the ancient past.

Not many miles to the south, a keen-eyed farmer, J. W. Parker, discovered the clew which gave the Smithsonian Institution, at Washington, D. C., a much-desired mammoth skeleton. Parker was examining the caved-in bank of a large drainage ditch following a heavy freshet when he noticed some huge bones protruding from the earth. Under the direction of Dr. [\(Continued on page 117\)](#)



J. T. Fox with a few of the 8,000 specimens in his private natural-history museum at Seaford, N. Y.

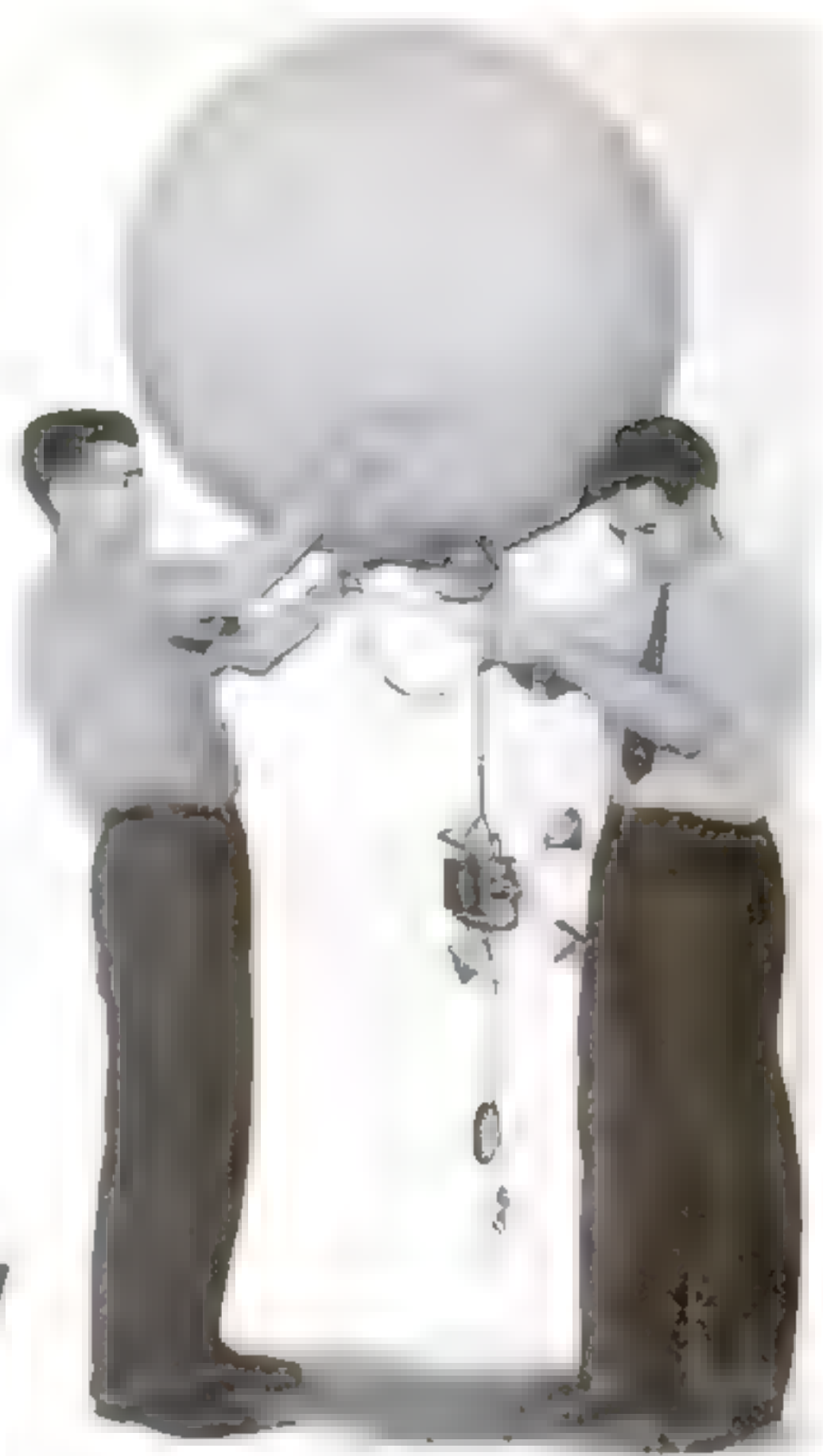
ELECTRIC MAP ANSWERS QUESTIONS

AN ELECTRIC map now automatically aids motorists seeking travel information at the headquarters of the Automobile Club of Southern California. At the touch of a button, the mileage to any of 1,000 points within the state flashes

from an electrical panel in luminous green figures, while a bright red spot indicates the location of the place upon a map twelve feet high. The thousand answers this instrument "knows" are given through an electrical brain whose cells are 1,000 relays, interconnected by thirteen miles of wire. Figures are flashed from a board whose 460 tiny light bulbs are arranged to form the required digits through eighty-seven separate circuit combinations. Shining through a sheet of prismatic glass and one of stained glass, the individual light beams merge to form solid lines, glowing like neon tubes. The figures can be clearly read 200 feet or more away. The device was planned to answer the questions of the 100,000 persons who each year call for travel information, and to aid employees in answering telephone inquiries.



At the touch of a button, this automatic device flashes on a panel the mileage to any one of 1,000 places in the state, while a spot of light marks its location on the map



CREWLESS BALLOONS AID STUDY OF HURRICANES

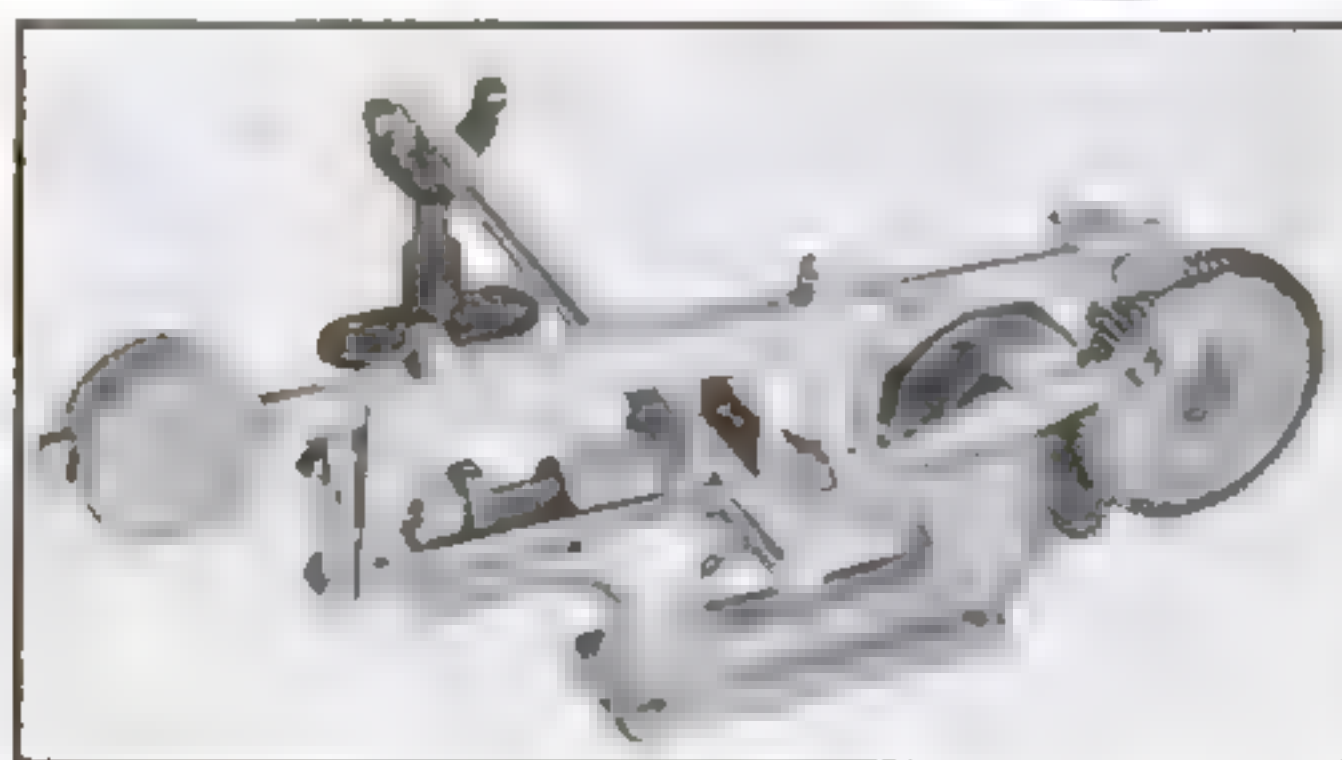
SEEKING the underlying causes of the hurricane belt that extends over the Caribbean Sea and the southern United States, experts of the Massachusetts Institute of Technology plan to explore the upper air of the region with the aid of miniature, crewless "sounding balloons." Each of the gas bags will carry aloft weather instruments and a diminutive, automatic radio transmitter that broadcasts their readings to the ground observers. The tests are expected to aid in predicting storms.

RAZOR OPENS ITS JAWS TO RECEIVE NEW BLADE

CLEANING or replacing a blade is made easy by a new safety razor equipped with a head that opens or closes when a knurled ring at the end of the handle is twirled. This feature eliminates loose parts that may become separated or fall to the floor, and an added advantage is that the user may regulate the closeness of his shave to suit his taste. When the ring is screwed up tightly, the blade is curved in the proper position for ordinary shaving; while unscrewing the ring a fraction of a turn allows the blade to spread away from the guard for an extra-close shave. The flexible blade adapts itself to the holder's position.



The knurled ring at the end of the handle opens the razor head



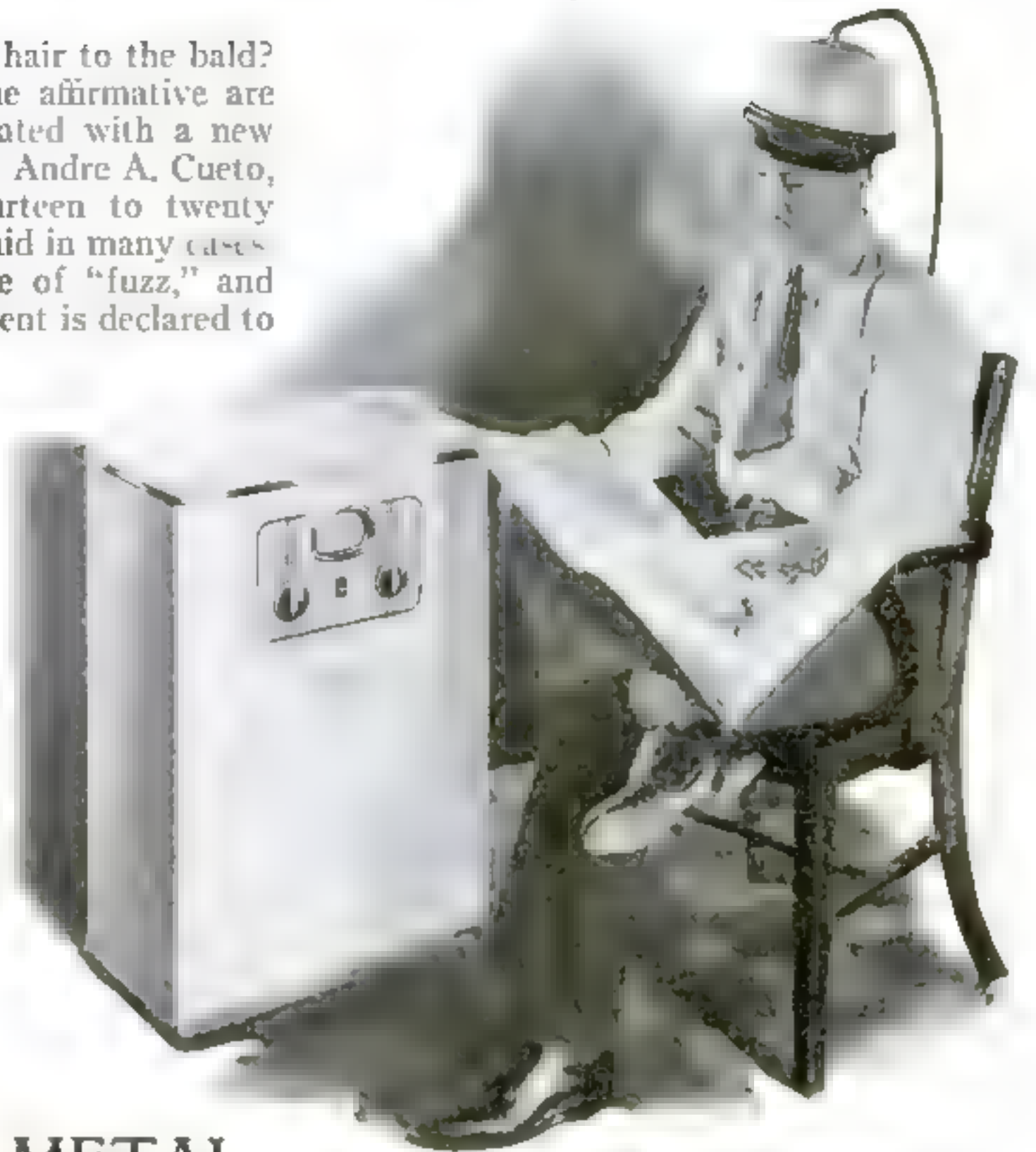
POWER HACK SAW FOR THE HOME HAS SIMPLIFIED DESIGN

INGENIOUSLY simplified construction makes a power hack saw of new design unusually inexpensive and easy to operate. Especially suited for use in home workshops and garages, the portable tool is declared accurately machined, to insure true cutting, and able to withstand hard usage. Stock up to two inches in thickness can be cut with its aid. An eight-inch saw blade is employed, operating at a speed of 125 to 150 strokes a minute, and a quarter-horsepower electric motor runs it.

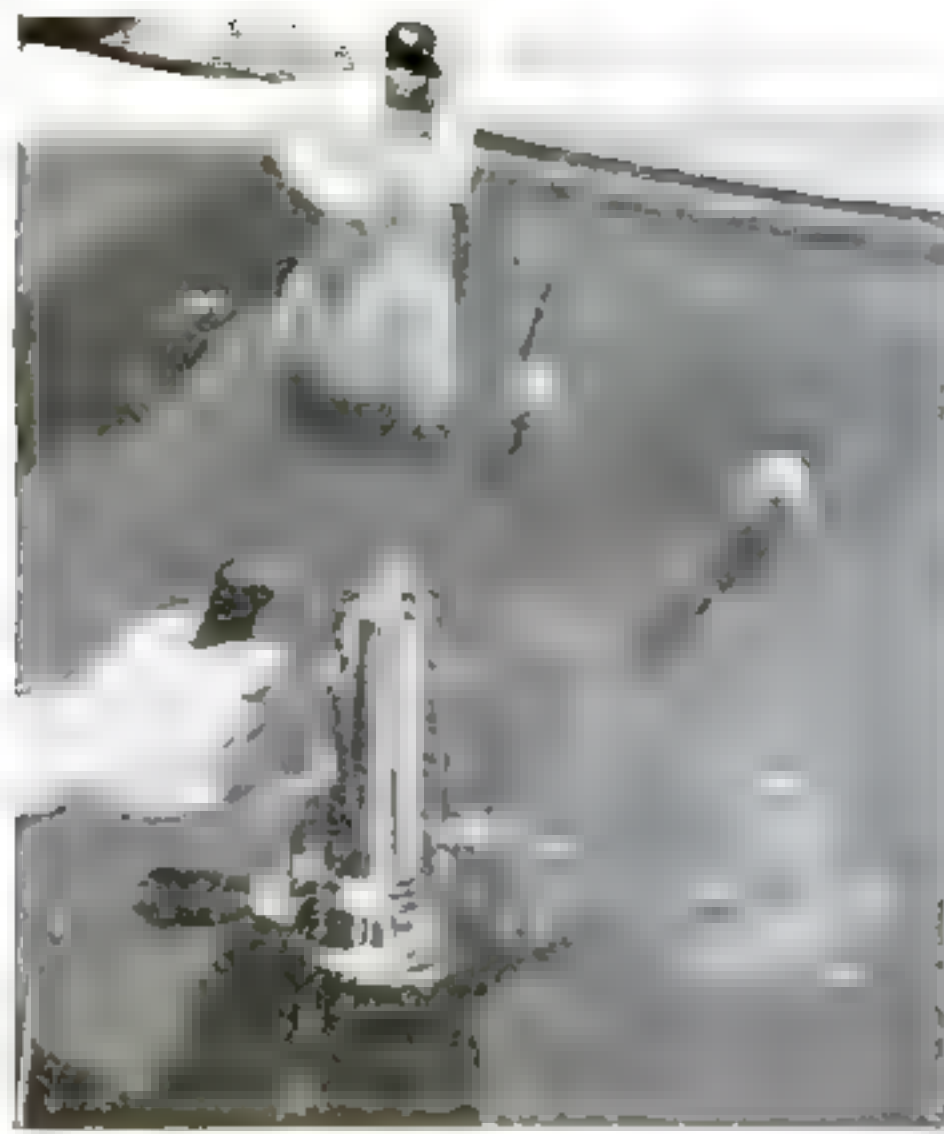
Stock up to two inches thick can be cut with the simplified power hack saw illustrated above. It is operated by a quarter-horsepower electric motor

USE VACUUM TO AID HAIR GROWTH

CAN SCIENCE restore hair to the bald? Startling results in the affirmative are reported in 500 cases treated with a new machine, developed by Dr. Andre A. Cueto, of Cincinnati, Ohio. Fourteen to twenty half-hour treatments are said in many cases to produce the appearance of "fuzz," and from this point on the patient is declared to progress toward a normal growth of hair. Alternately applying air pressure and vacuum through a cap, the device, it is claimed, restores the functioning of the blood vessels that nourish the hair follicles. Abnormal hair growth upon the legs of hospital patients treated with a circulation-stimulating machine known as a "glass boot," operating on a similar principle, suggested the new machine, perfected for commercial use.



A patient receiving the vacuum treatment for baldness while he reads and smokes in comfort



STEAM TAKES BLEMISHES OUT OF UPHOLSTERY

PRODUCING a fine cloud of dry steam, as shown above, a new electric vaporizer is said to remove wrinkles, creases, and other types of disfiguring marks from clothing, upholstery, and carpets. The treatment is also said to kill moths and their larvae.

CHEMICAL PROCESS RUSTPROOFS METAL

A CHANCE discovery of a way to keep metals from rusting has just boosted a British workman from a twenty-dollar-a-week job as a plater to a prominent post in a \$175,000 company. Motor-car makers, small-arms factories, aviation firms, and gas companies are said to be negotiating for the use of his process, which consists merely of a four-minute chemical bath. If the discoverer's claims that it rustproofs any metal prove justified, he has every chance of becoming one of Britain's leading industrial magnates. The importance of such a process may be gauged from the fact that replacement of rusted objects accounts for an impressive part of the world's annual billion-ton consumption of metals—a staggering figure amounting to 1,000 pounds yearly for every man, woman, and child upon the earth.



Harry Webb, inventor of a process for rustproofing metal, trying it out by reconditioning parts of a stove

ODD "PINWHEEL CAMERA" CATCHES LIGHTNING

VAGARIES of lightning bolts are recorded with a "pinwheel camera" devised by Prof. John G. Albright of the Case School of Applied Science. At the height of an electrical storm, the shutters of the cameras mounted on a wheel are opened, and the wheel is rotated rapidly by hand. A multiple lightning discharge along a single path is recorded as a series of parallel streaks, and a study of the film gives a clear picture of its behavior. Through the curious arrangement of the cameras, every part of the sky is covered.



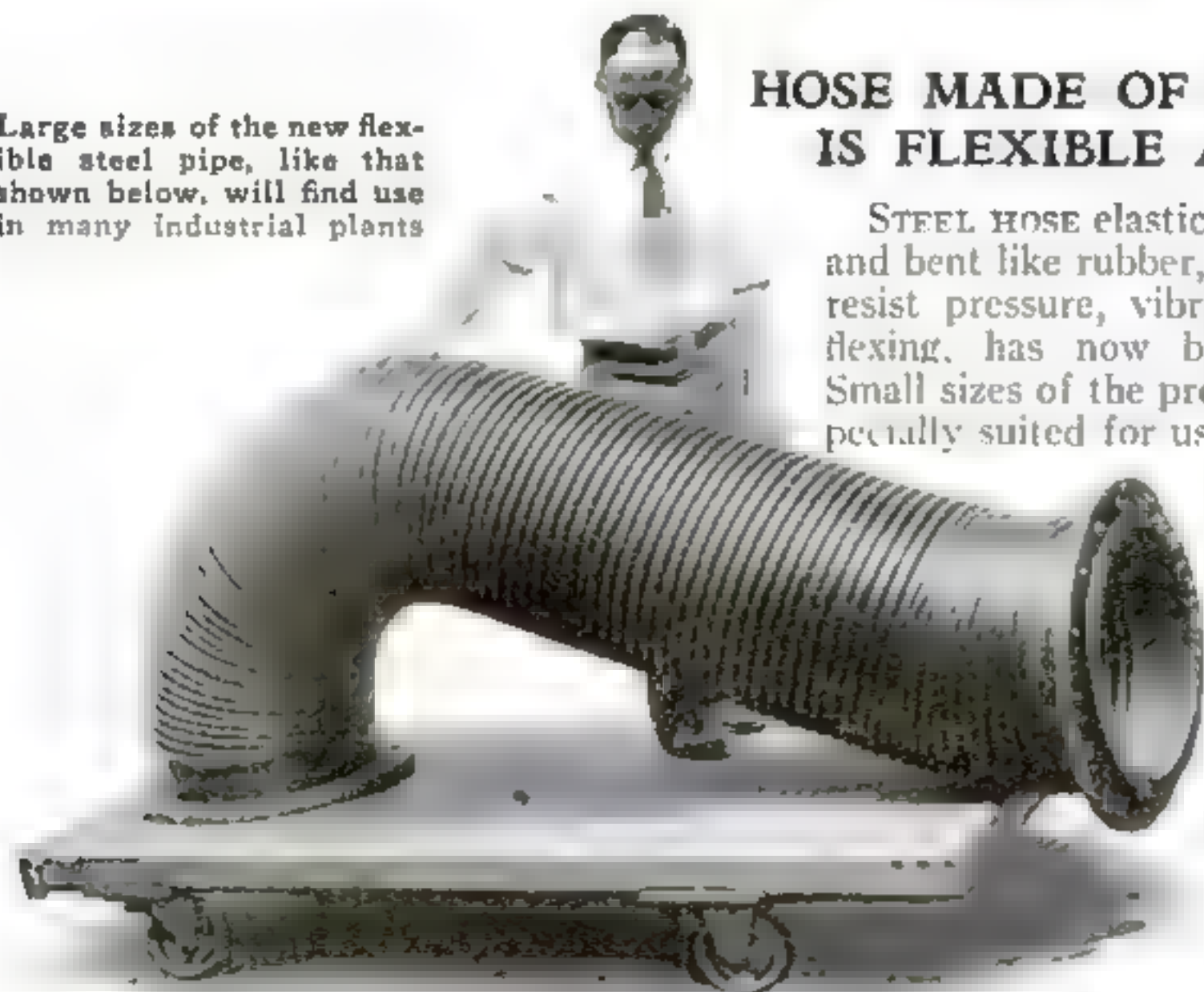
Spun rapidly in a storm with shutters open, this battery of cameras gets unusual lightning views

HOSE MADE OF HARD STEEL IS FLEXIBLE AS RUBBER

STEEL HOSE elastic enough to be twisted and bent like rubber, yet strong enough to resist pressure, vibration, and continued flexing, has now been made available. Small sizes of the product are declared especially suited for use as fuel lines in motor vehicles, and for housing control wires in airplanes and motor boats.

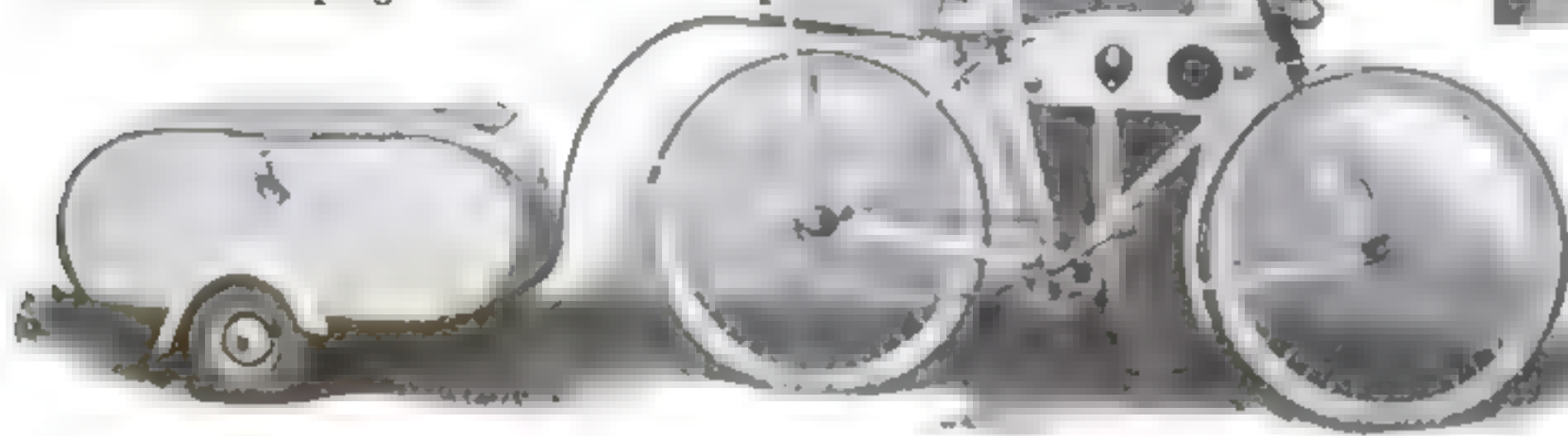
Bellowslike corrugations in the metal wall of the hose account for its amazing flexibility, which is strikingly demonstrated in the accompanying photograph.

Large sizes of the new flexible steel pipe, like that shown below, will find use in many industrial plants



BIKE FOR TOURING HAS RADIO AND TRAILER

How to fit a bicycle for cross-country travel was recently demonstrated by Hubert J. Phillips, of Cheyenne, Wyo., who added a homemade trailer and radio to his machine for a tour to the Pacific Coast. Weighing thirty-five pounds empty, the trailer holds a one-man camping outfit.

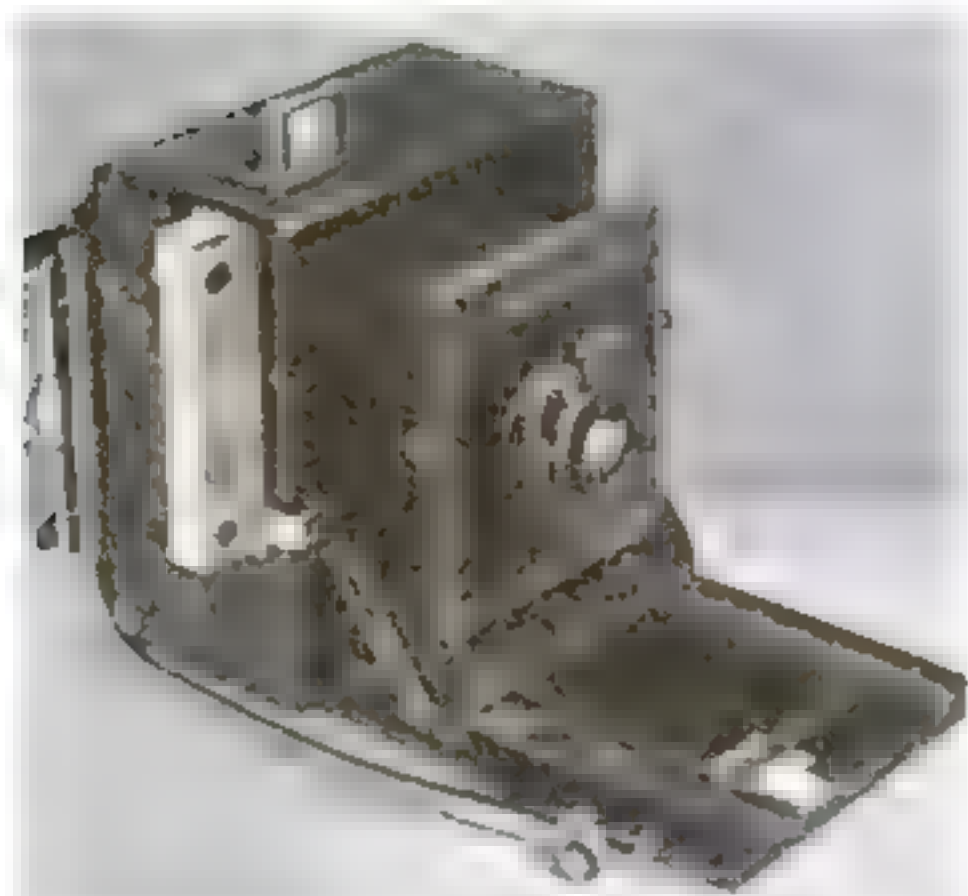


Hubert J. Phillips and the bicycle that he equipped with a homemade radio and trailer



KEY SETS CAR-SPEED GOVERNOR

With a new speed governor attached to his car's carburetor, the owner can make sure that no reckless borrower will operate his machine at a risky pace. By inserting a key in a dashboard lock, as in the view at upper left, he can set or disconnect the control device at will. The governor, which can be adjusted for any desired maximum speed, is shown at upper right.



CAMERA RANGE FINDER GIVES QUICK FOCUS

DIRECTLY connected to the focusing mechanism, a quick-acting range finder just introduced for large cameras allows the same high-speed focusing adjustment provided by modern miniature cameras. Instead of reading the dial of an independently operated distance meter and setting the camera's focusing scale accordingly, the user simply racks out the bellows until the new accessory shows that his camera is correctly focused.

NEW PROCESS PRINTS PHOTOS ON WALLS

MONSTER photographs, imprinted on walls through a process developed by two British inventors, offer a striking new way of decorating homes and buildings. The wall is first sprayed with a plastic paint containing asbestos, and then with a light-sensitive silver emulsion that adheres to the prepared surface. An enlarging lantern now projects the picture upon the wall. Developing and fixing solutions are next applied with a spray gun, followed by a final protective coat of lacquer. Using the new scheme, the largest theater could be redecorated throughout in a few hours' time. Since the pictures obtained are impervious to the weather, they may be applied outdoors, and advertising could be affixed to billboards overnight.



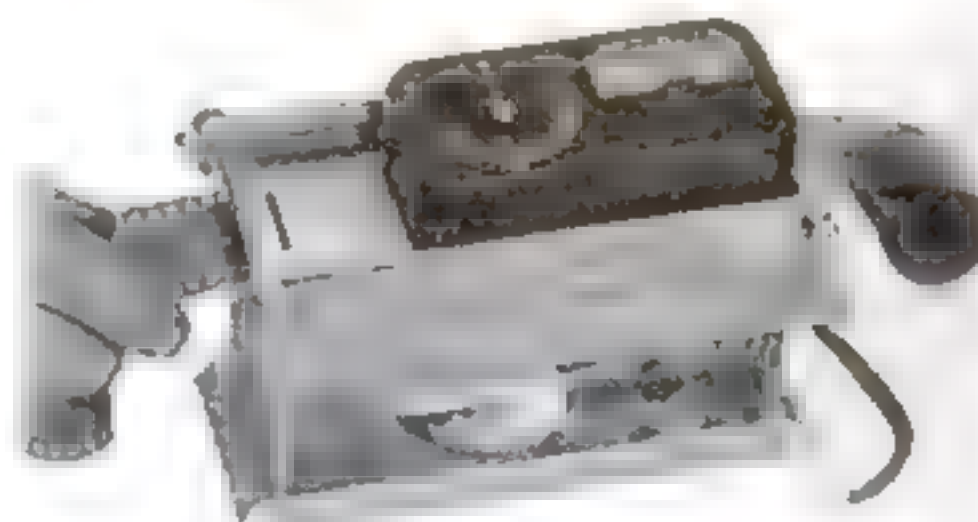
To imprint a photograph on a wall, the prepared surface is first sprayed with a silver emulsion. The picture is next projected on the wall, and then developed and fixed and sprayed with lacquer

DOG'S BARK TONED DOWN BY OPERATION



An Atlanta, Ga., veterinarian cutting a slice out of a dog's vocal cord. This painless operation is said to muffle the animal's bark

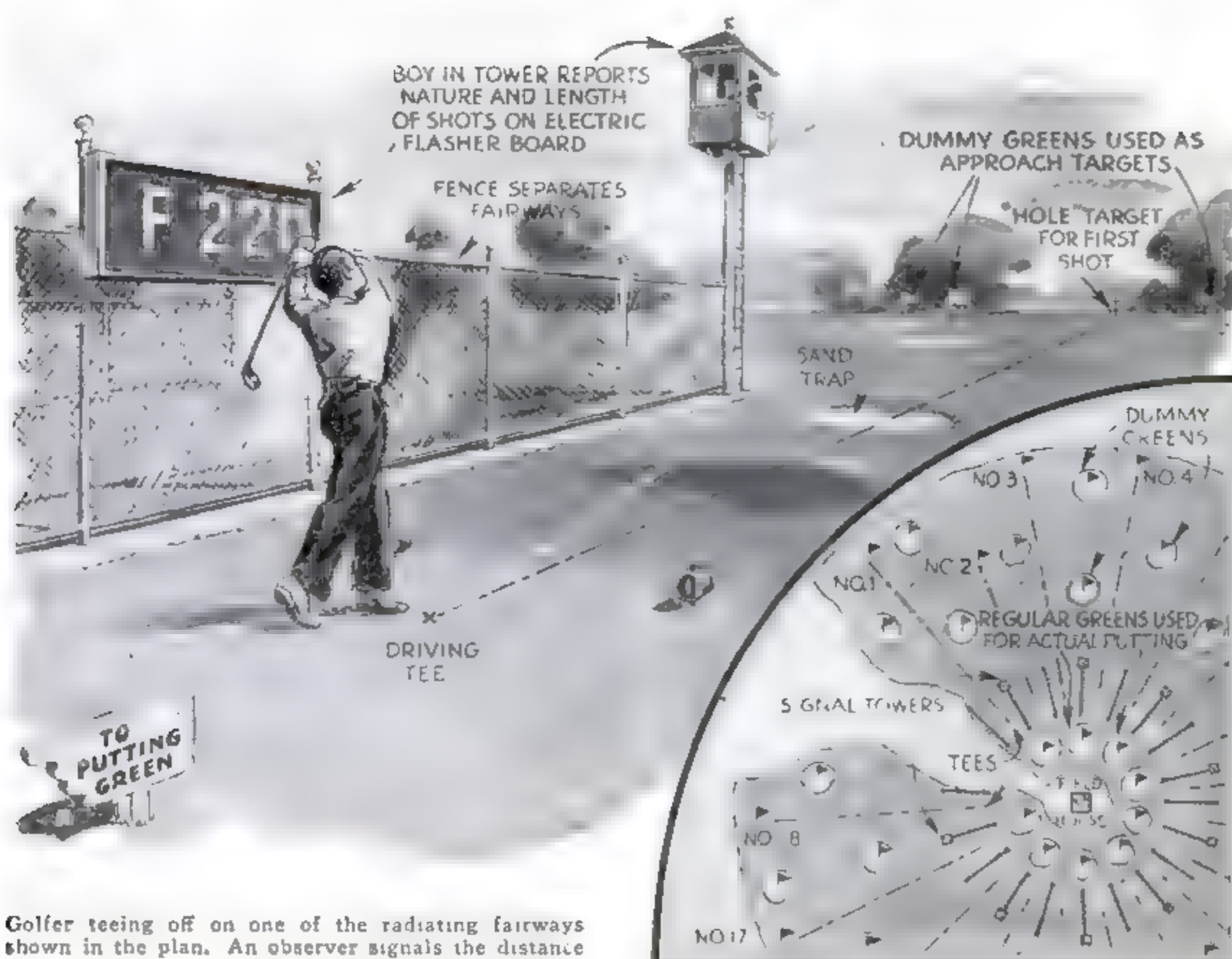
TONING DOWN the barking of noisy dogs is the reported accomplishment of an Atlanta, Ga., veterinarian, who has performed the feat upon the pets of a number of apartment dwellers. In the simple, painless operation that he has devised, a dog's vocal cord is relieved of a small V-shaped wedge on either side. No danger to the animal is involved, it is said, and the only after effect is that an ear-splitting bark is muffled to a dulcet tone that can cause no complaints from neighbors. In the photo at left, a pet is under treatment.



"ELECTRIC EYE" TIMES PICTURE ENLARGING

TIMING enlargements from miniature negatives is simplified by a new "electric-eye" meter, similar in principle to photoelectric exposure meters currently used in picture taking. Light from the entire negative is projected upon a sensitive element, and a scale reading shows the proper exposure time. The meter also indicates the grade of enlarging paper to use, shows the general condition of the negative, and reveals whether the developing process has been correct.

WHEEL-SHAPED GOLF COURSE SAVES TIME AND SPACE



Golfer teeing off on one of the radiating fairways shown in the plan. An observer signals the distance

WITH fairways radiating out from a central point like the spokes of a wheel, a new kind of golf course, recently devised by an Illinois inventor, makes it possible to play eighteen holes of sporty golf in a forty-acre field. Players drive from a central point and work from one fairway to the next around the wheel. As each player drives from a fifty-yard long tee down the fairway, a boy in a tower sights the ball and reports by an electric flasher board the distance and the nature of the shot. A second ball then is played from the tee toward one of three dummy greens approximately the remaining distance. The result of this shot also is relayed by the tower boy. The player then places another ball on a part of the long tee which closely reproduces the lie and position of his second ball, and follows through for the completing shots that carry him back to a regular green behind the tee.



BUILDS OWN TELESCOPE FROM P.S.M. PLANS

FROM plans published in **POPULAR SCIENCE MONTHLY**, John E. Flynn, of Yakima, Wash., has built a sixty-inch refracting telescope that he declares superior in performance to a neighbor's instrument costing nearly \$200. A carpet tube forms the barrel of the homemade telescope and a pair of magnifying glasses, one of them reground, serve as lenses. The total cost was only a few dollars. In three months, 118 visitors have come to look through the telescope, which is shown with its builder in the picture above.

INTERLOCKING LETTERS FORM STENCILS

DURABLE stencils may be prepared in a jiffy from interlocking sections of spring brass, now on the market. The sections bear individual letters and may be joined to form any desired combination of initials or words, as shown in the illustration at the right. The resulting marker may be used indefinitely. When it is no longer required, a slight push separates the letters and they are available for future use in other combinations.



Brass sections are joined in any combination to make a sturdy, durable stencil

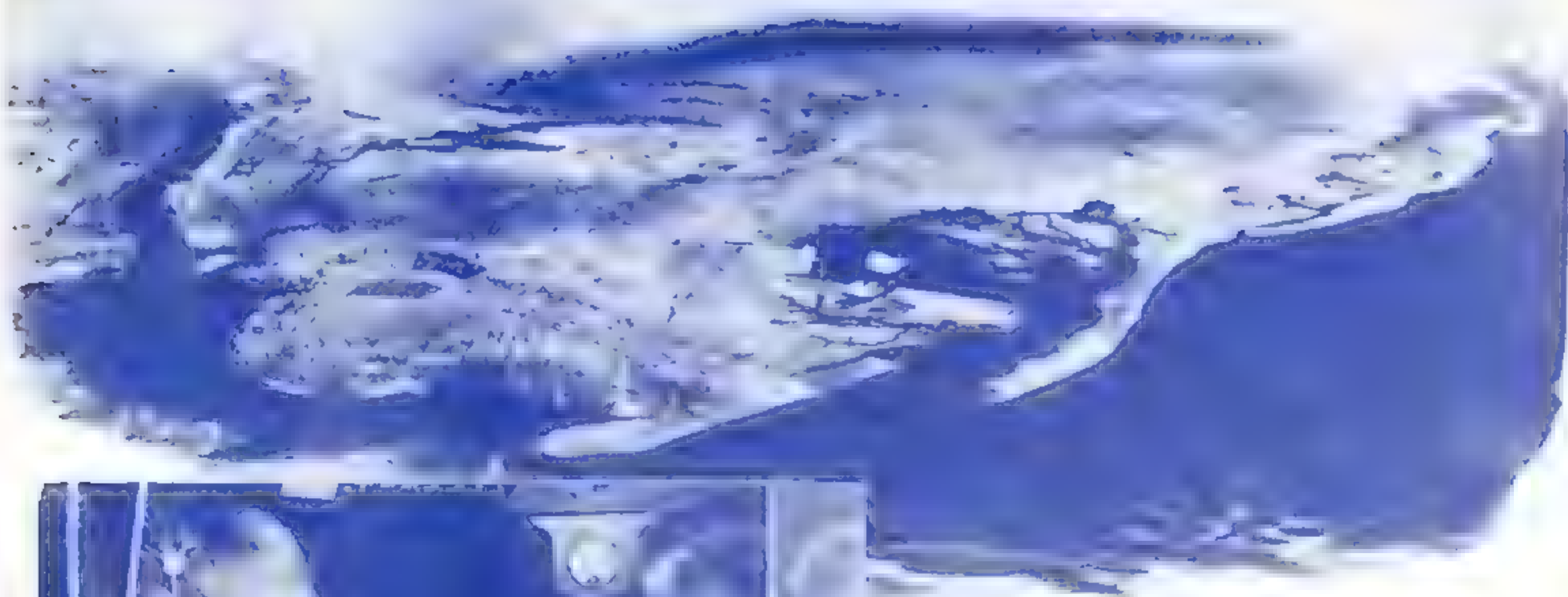
MUSIC MADE VISIBLE IN WEIRD MOVIE

FUTURISTIC patterns of light and shadow are projected upon a movie screen to accompany the music of Wagner's "Song to the Evening Star," in a unique sound film recently completed for exhibition in a New York theater. Marching rhythmically across the audience's field of view, the odd designs were produced by trick photography, with the aid of bracelets, toy balls, silks, and crushed tissue ribbons.



Ellen Bute, director, and Ted Nemeth, photographer, who made a movie of a song. Left, a "scene" from the film

Aviation's Last Frontier



By EDWIN TEALE

GLINTING in the sun high over Kansas City, Mo., a silver speck disappears in the blue. It is a winged laboratory, a \$350,000 experimental plane blazing a trail for air lines at the top of the sky.

For weeks, with Capt. D. W. Tomlinson at the controls, this low-wing, all-metal Northrup monoplane, built especially for the Lindbergh Line, TWA, has been climbing into the cold, thin air of the 30,000-foot level. Within the cabin, lights flash on and off, automatic cameras click and films record—minute by minute—the readings of a battery of dials and gauges. Thus, on strips of celluloid, science is writing new chapters in the story of the stratosphere.

While this pioneer ship is surveying the possibilities for high-altitude air lines, other explorers of the sky are grooming their planes for similar work.

Howard Hughes, sportsman pilot, is making long-distance test flights in a swift Douglas plane with a sealed cabin. Clarence Chamberlin, veteran transatlantic flier, is preparing for a hop to Europe through the stratosphere. Amelia Earhart, with the coöperation of Purdue University, is installing an elaborate array of scientific apparatus in a special twin-engined "laboratory plane" built at the Lockheed



Capt. D. W. Tomlinson and a companion in the cockpit of a high-altitude plane, wearing oxygen masks of the type used in excursions to the roof of the world. Above is a view of New York City and its environs from the sub-stratosphere

..... *Flyers* BLAZE NEW SKY

plant in Burbank, Calif. From coast to coast, a new assault is beginning on aviation's last frontier.

Hardly more than three decades ago, this frontier was unknown and undreamed of. The world of science accepted the theory of a one-piece atmosphere in which the temperature dropped steadily as you ascended. Then, about 1902, the sounding balloons of an amateur weather observer, a wealthy French bachelor who always spoke of his observatory as his wife, revealed a surprising thing. At approximately 33,000 feet, the thermometer stood still. Beyond that, the temperature apparently remained constant at between sixty and seventy degrees below zero F. In some instances, it even rose slightly. It is this lonely realm of eternal cold that the amateur, Leon Teisserenc de Bort, named the "level zone," or stratosphere.

Since then, aerial explorers have added much to our knowledge of this high tableland of the sky.

We know, for instance, that cosmic rays are 100 times as numerous there as on earth. We know that the stratosphere is higher above the earth in summer than in winter. We know that it is lowest over the poles and highest over the equator. And we know that, in topsy-turvy fashion, the stratosphere is colder above the tropics than above the arctic ice fields.

A region where the air is free from fogs, storms, gusts, and bumps; a region where all weather is good weather, where steady, sweeping winds and reduced atmospheric pressure will enable "thin-air" machines to make terrific speeds—that is the stratosphere. It is there, experts agree, you will find the far-flung air lines of the future.

Today, on the trail of the pioneers is coming the scientific push of commercial air lines. Stratosphere exploration has entered its second phase.

The story of man's early climb into this borderland of the unknown is comparatively recent history.

In 1927, the ill-fated Capt. Hawthorne Gray, of the U. S. Army, rode his open-basket balloon from Chanute Field, Ill., to a height of 42,470 feet, losing his life miles above the earth when his oxygen supply failed. There followed the work of crack plane pilots who pushed into the lower fringes of the stratosphere, lifting the peak of their climb until the Italian, Commander Renato Donati, set a mark of 47,352 feet, more than nine miles above the earth.

It was in 1931, however, that the world became stratosphere-conscious.

An obscure Belgian university professor, Auguste Piccard, startled scientists by soaring with a companion ten miles above the fields of Central Europe enclosed in an air-tight aluminum ball seven feet in diameter. Everyone remembers that Jules Verne journey: how the professor saved the day by stuffing oakum and grease into leaks in the metal ball and how, after the valve rope snapped—ten

miles in the air—the great balloon drifted out of control for hundreds of miles across Europe to a safe landing on an Alpine glacier. Piccard is the Columbus, his balloon the *Santa Maria*, of the stratosphere.

Only two man-made things had ever gone higher: sounding balloons, and the projectiles from the Big Bertha which shelled Paris during the World War. Unmanned balloons have ascended to a height of twenty-three miles, and it is estimated that the shells of the monster cannon reached an elevation of thirty-four miles in their arc from behind the German lines.

The next year saw Piccard again exploring the upper air with his scientific instruments. In rapid succession, he was followed by Russian and American aeronauts. Their journeys made newspaper headlines and set new records.

There was the amazing escape of Commander T. G. Settle, in 1933, when his balloon was forced down in a Chicago railway yard. There was the tragic end, in 1934, of three Russians, dashed to death in their falling gondola. In the same year occurred the parachute jumps that saved the lives of Capt. Albert W. Stevens, Capt. Orvil Anderson, and Major William Kepner, (*Continued on page 86*)



COMING DOWN FOR AIR Howard Hughes, sportsman pilot, leaving the scaled cabin of his swift Douglas plane after a long-distance flight through the thin upper air. Ships that sail the stratosphere must take an oxygen supply along.

ARTIFICIAL STRATOSPHERE In the air-tight chamber shown at the left, Italian aviators are tested under atmospheric conditions reproducing those at a height of 60,000 feet, to test their fitness for battle far above the earth.

TRAILS MILES ABOVE THE EARTH

NOVEMBER, 1936

Ancient Bricks Reveal History of Plants



Screening dissolved adobe bricks in the field to obtain the plant remains they contain. At left, a portion of a typical brick and piles of the twigs and seeds recovered from a similar sample

CENTURY-OLD fragments of plants "embalmed" in ancient bricks are helping Prof. G. W. Hendry of the University of California to construct a novel plant calendar, fixing the dates when flowers and vegetables of alien origin first were brought to the United States. Builders of old Spanish missions and other historic structures used fifty-pound bricks of mud, which they mixed with any available plant material to make it hold together. Prof. Hendry places one or two of these bricks in water, lets them stand overnight, pulverizes them, and pans the muddy water much as a prospector pans for gold, using sieves to catch the handful of plant

fibers and seeds that each brick contains. Examined under the microscope, specimens from different localities reveal how plants brought from Spain by the mission fathers were transported across Mexico, introduced into California, and spread through the West. Among the varieties thus acclimated, Prof. Hendry has identified roses, wheat, barley, oats, peaches, figs, beans, peas, carrots, and watermelons, all of which owed their introduction to the travels of the missionaries.



An expert examining plant fragments under a high-powered magnifier to identify and classify them

HANDY CONNECTOR SIMPLIFIES WIRING

ELECTRIC wires are readily joined, without recourse to ordinary splicing methods, through the use of a handy new connector. The wire ends, stripped of insulation,

are inserted in a core of seamless brass tubing, which is threaded at the center and split at the ends. A pair of molded plastic insulators are then pushed over the tube from each side, forming a snug "push fit" with one another. The insulators are threaded internally, and when they are screwed together the brass core is clamped down over the wire ends with a vise-like grip, forming a tight joint and giving a high degree of electrical conductivity.

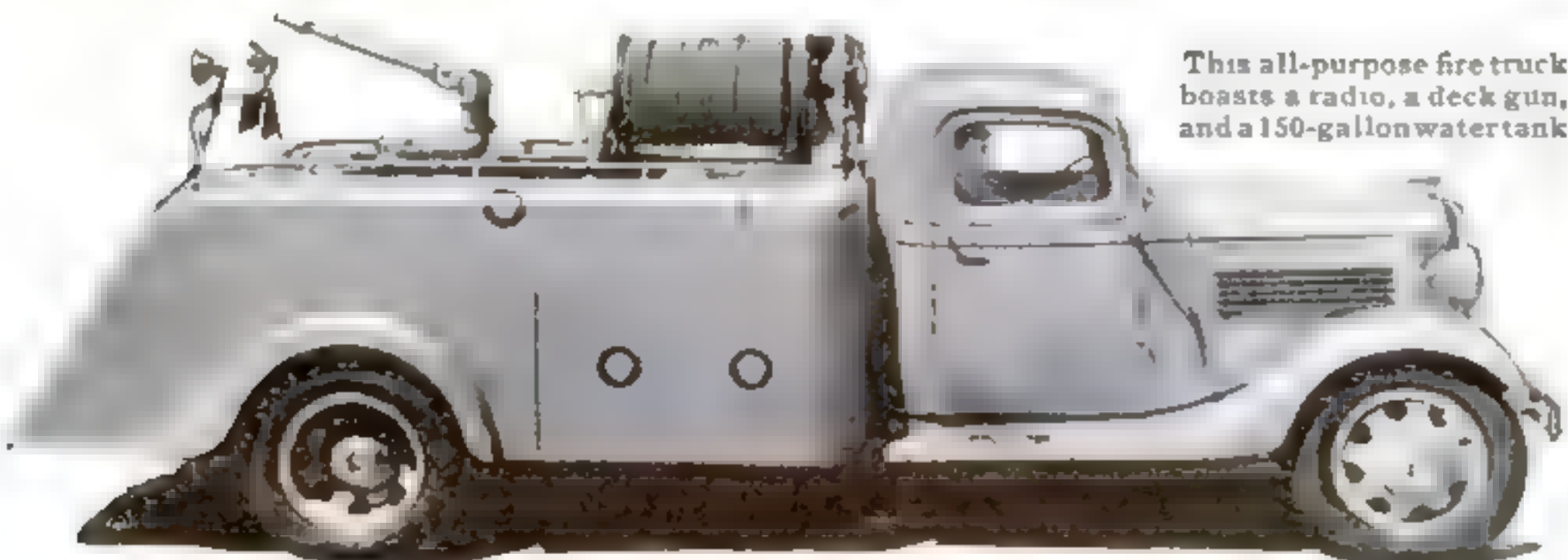


How the connector is used to splice two wires. Made of molded plastic, it insures perfect insulation

FIRE TRUCK CARRIES OWN WATER SUPPLY

DESIGNED by the fire chief of Saugus, Mass., an all-purpose fire truck just placed in service there is declared to be the only one of its kind in the world. The versatile machine serves as a hose wagon, a forest-fire fighting apparatus, a pumper, and a "traveling hydrant." A short-wave

radio set is one of its ultra-modern features, and its equipment also includes a 200-gallon-a-minute pump, a 150-gallon booster tank, a deck gun, and half a mile of hose. Its unusual features enable the truck to operate independently of the city water supply.



This all-purpose fire truck boasts a radio, a deck gun, and a 150-gallon watertank

ELECTRIC DOOR LOCK REQUIRES NO KEY

No KEY is required to operate a novel electric door lock, recently exhibited in Chicago, Ill. The user merely has to push the right buttons selected from a circular row of eight, resembling a telephone dial, and the door will open. Pushing the wrong buttons not only fails to open the door, but sets off an alarm bell that rings for seven minutes. The owner can change the "combination" at will, and dozens of settings are possible.





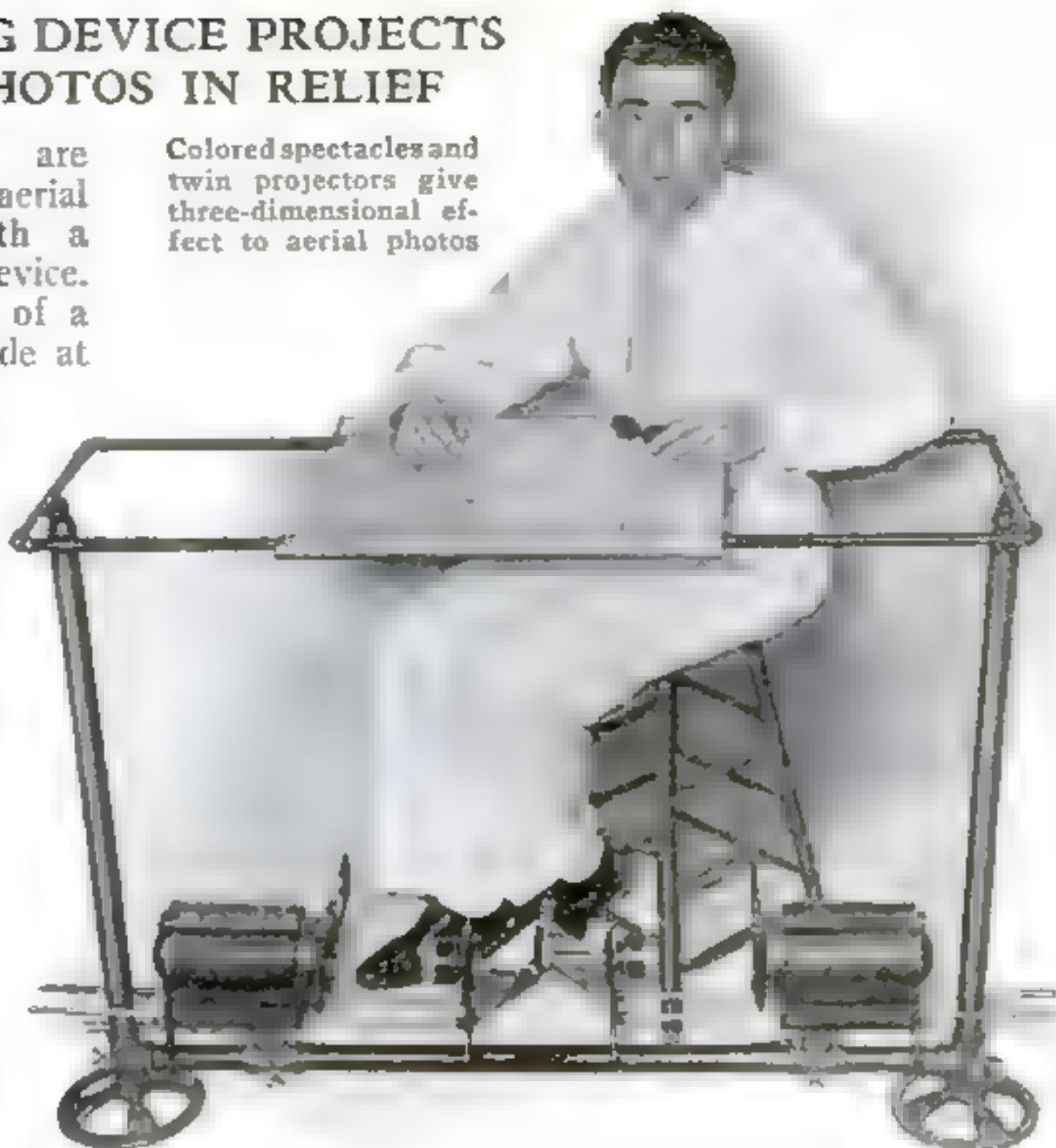
BIGGEST GUITAR IS PLAYED LIKE A BASS FIDDLE

BELIEVED to be the world's biggest guitar, this six-foot instrument, recently demonstrated in Chicago, combines the resonance of the bass fiddle and the tones of the guitar. The "Bassoguitar," as the new instrument has been named, is played by slapping and plucking the strings like a bass fiddle.

MAP-MAKING DEVICE PROJECTS AERIAL PHOTOS IN RELIEF

CONTOUR maps are easily made from aerial photographs with a new projection device. Two aerial photos of a single area are made at slightly different angles and the images are projected onto the under side of a glass drawing board, one through a red filter and the other through a blue one. Donning glasses fitted with one red and one blue lens, the map maker sees a three-dimensional reproduction which can be easily traced. With this device, it is easy to estimate elevations.

Colored spectacles and twin projectors give three-dimensional effect to aerial photos



"STETHOSCOPE" FINDS MOTOR ILLS

For locating the source of motor noises and engine trouble, a Cleveland, Ohio, concern has recently brought out an electric instrument resembling a physician's stethoscope. A thin rod carries vibrations to a microphone in which electric impulses are set up by salt crystals and transmitted to the headphones. So sensitive is the stethoscope that even the faintest of vibrations can be detected with it.



This instrument traces motor vibrations

The designer holding a model of the new plane designed for amateur flyers



WELLS REDUCE EARTHQUAKE FIRE PERIL



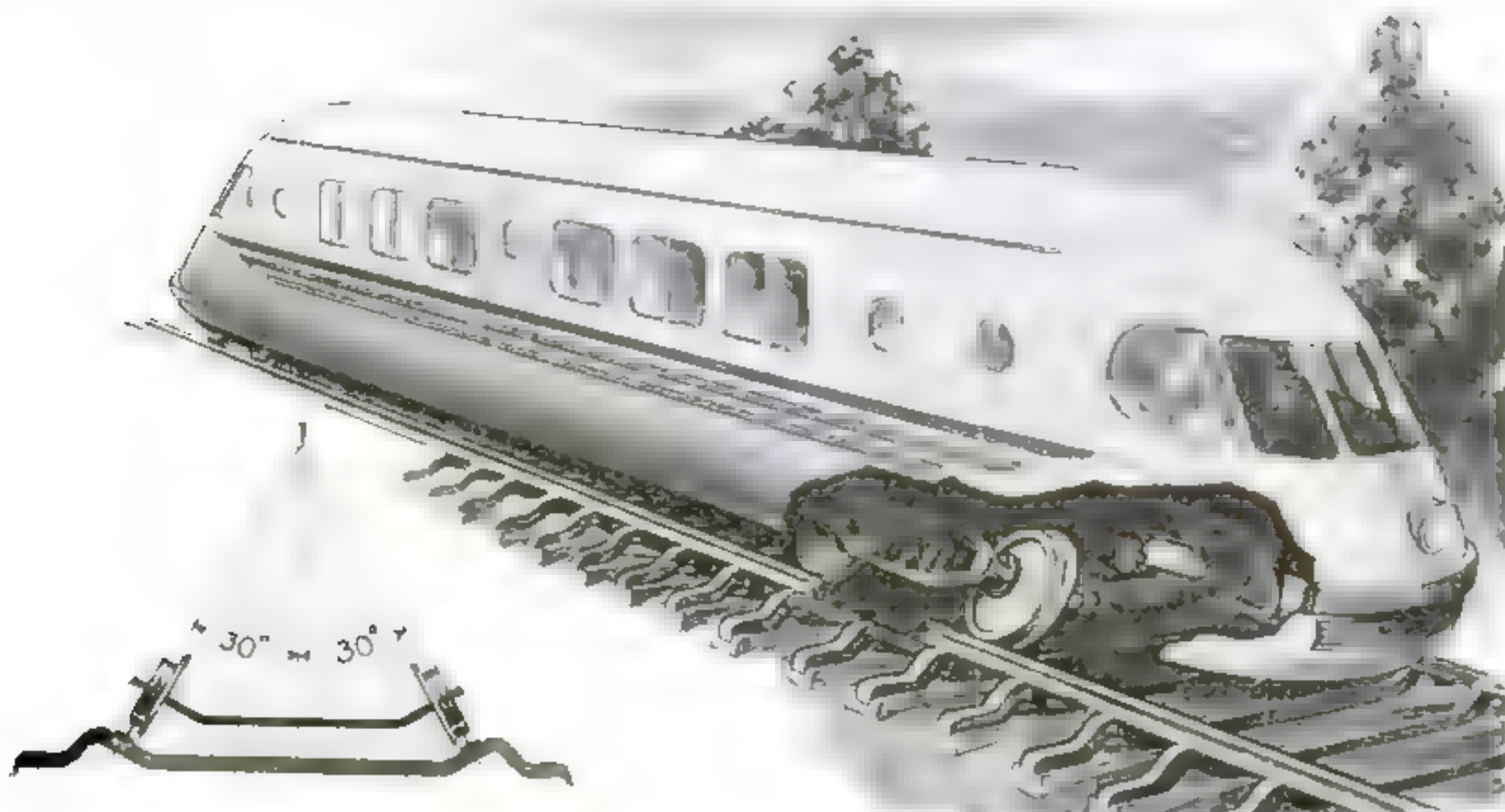
One of the storage wells being dug in San Francisco for earthquake use

TO INSURE an adequate water supply for fire fighting in the event that an earthquake destroys the water mains, San Francisco, Calif., is constructing storage reservoirs at strategic points throughout the city. Each of these huge wells is fourteen feet deep and thirty feet in diameter, and holds 75,000 gallons of water, enough to keep a fire pump of the latest type going for an hour and a half. The city will install 180 of these water-storage wells as part of a program of preparedness against possible disasters.

ROCKETLIKE PLANE HAS SPEED WITH SAFETY

RESEMBLING a rocket more than it does any conventional type of aircraft, an odd plane designed by a French inventor is intended to give private flyers the advantage of high speed combined with safety of operation. The designer, who is shown above with a model of the "Arrow Plane," as the revolutionary craft is called, claims that it will be able to reach a maximum speed of 280 miles an hour.

SAFETY TRACK FOR STREAMLINERS PERMITS HIGHER SPEED



Drawing shows construction of proposed safety track for fast streamline trains, and corresponding design of wheel trucks. This plan, the inventor claims, would resist side sway and hold the speeding car on the track

STEAMLINE trains could safely whiz at speeds of 225 miles an hour or more over a track designed by Prof. Kurt Weisinger, of Zurich, Switzerland, according to the inventor. Instead of being set upright as in standard practice, the rails would be inclined toward each other at an angle of thirty degrees from the perpendicular. Wheels of vehicles using the track would be similarly slanted. Because of the resulting resistance to side sway, Prof. Wiesinger maintains, derailment from this cause would be reduced to a negligible hazard. As an additional safeguard, extra-wide flanges on the wheels of the car would engage the under sides of the rails and resist any tendency of the vehicle to leave the track in an upward direction.

TINY ELEPHANTS CARVED OF IVORY ARE PACKED IN HOLLOW SEEDS

MINIATURE ivory animals and other figures, so tiny that their hand-carved details are visible only under a powerful lens, are the product of a Bombay, India, craftsman, who markets his creations to collectors all over the world. One of his accomplishments is packing from one to 125 carved elephants within a single hollowed-out seed no larger than an ordinary pea. The accompanying photograph, which is greatly enlarged, shows one of the largest of his miniatures, the seed that serves as a receptacle, and its ivory cap, compared with a pair of safety-match tips.



PORTABLE STERILIZER FOR LAKES

CAPABLE of being carried directly to the point where it is needed, a portable sterilizing outfit recently tried out successfully in England renders the waters of the old swimming hole germ-free and safe for bathers. A small boat carries motor-driven apparatus that prepares a

disinfecting solution on the spot and sprays it into the water in the required amount. A testing outfit included in the equipment shows how much sterilization the water needs, and indicates when it has been brought to a predetermined standard of purity.



Water-sterilizing outfit installed in a rowboat, in use on the Serpentine in Hyde Park, London, England, to make the water safe for bathing. The man in the stern is making a test of the water



SCULPTOR MODELS HEAD TO SOLVE A MYSTERY

FRAGMENTARY remains of a man's head, found last May in a clay bed on a north Haverstraw, N. Y., farm, have given a New York sculptor, Frederick Guinzburg, the hardest task of his career. With only the slimmest of clues to guide him, he has just completed "rebuilding" the head in a remarkable plaster likeness that may help police identify the victim. The photograph above shows a New York City detective examining his restoration.

INDOOR PLANTATION GROWS TROPICAL PAPAYAS FOR MARKET



These greenhouses contain 650 papaya trees grown under tropical conditions

SANITARY precautions as rigid as those of a hospital protect an indoor plantation at Encinitas, Calif., where papayas, a tropical fruit, are being grown for the first time on a large scale in the United States. Because of the susceptibility of the trees to germ and fungus diseases, the soil in which they grow is sterilized, and visitors and workers must dip their feet in a pan of disinfectant solution before entering. Steam-heated greenhouses maintain a tropical climate to preserve the flavor of the pulpy, golden-yellow fruit,

which weighs from one to eight pounds. The trees grow so rapidly that gardeners must cut off their tops when they are one year old, to keep them from pushing through the glass panes in the greenhouse roofs, twenty feet above the ground.



Papayas ripening on a six-months-old tree. Left, a worker disinfecting his shoes to avoid carrying germs or fungus to the trees



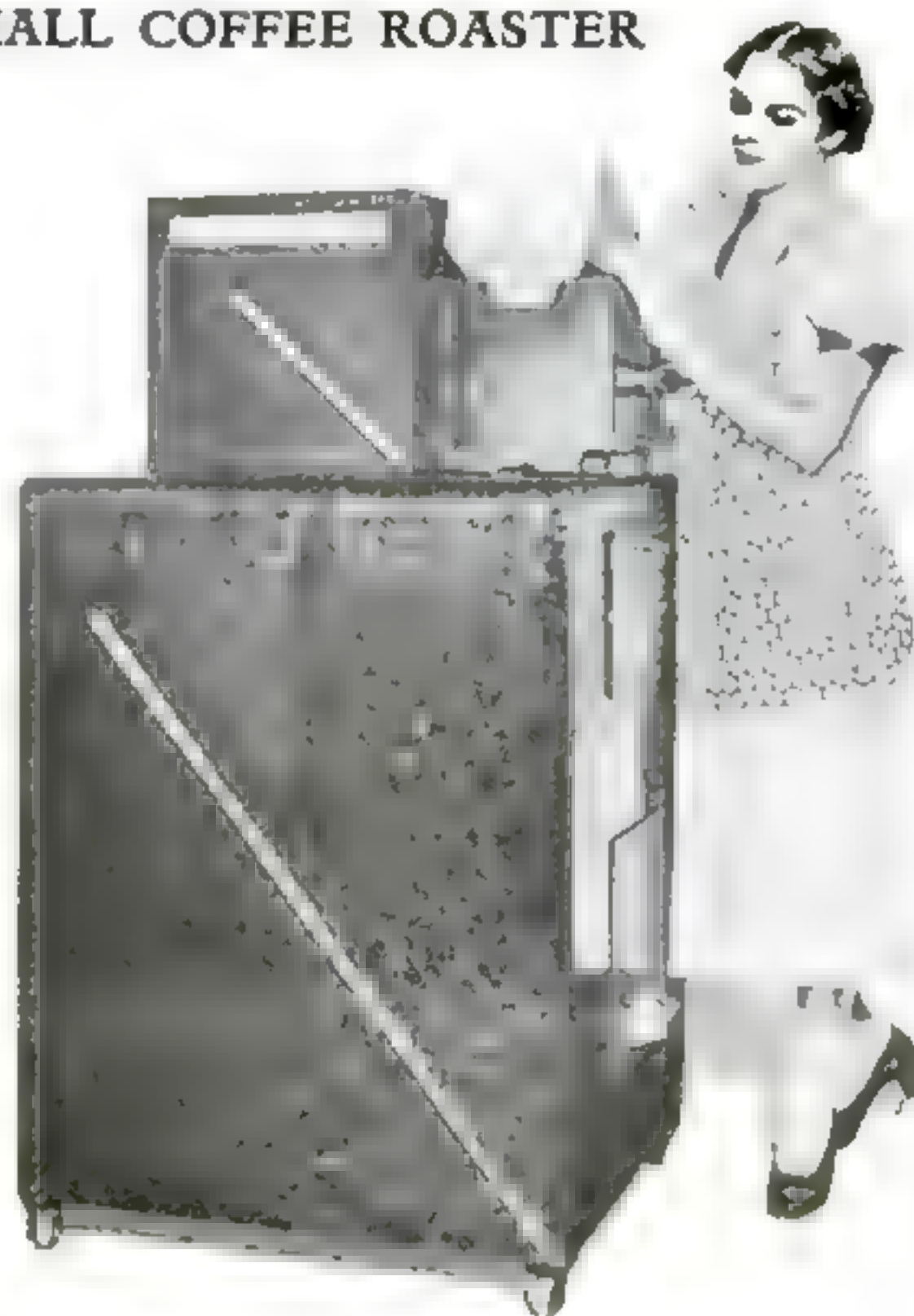
ELEVEN-POUND MUSHROOM FOUND

A SINGLE mushroom large enough to supply a banquet has been discovered and placed on exhibition in Switzerland. The phenomenal specimen tips the scales at eleven pounds, and measures more than a foot in diameter. In the illustration above, the giant mushroom is shown being weighed, while an observer checks its size with a centimeter scale.

STORES GET SMALL COFFEE ROASTER

HOUSEWIVES may soon have their grocers roast their coffee to order, assuring freshness of flavor and aroma, with the aid of a newly introduced electric machine. When a package of green coffee beans is placed in the top and a slide is closed, the bottom of the container is sheared off and the coffee is automatically roasted, cleaned, and cooled. The beans then fall into a drawer at the base of the machine, ready to be removed for grinding and delivery to the buyer.

A package of coffee beans being placed in an electric roaster made for small stores



Demonstration of froth-forming attachment for ordinary fire hose. Left, the special nozzle, and the tank that supplies a foam-producing chemical

FIRE-HOSE NOZZLE PRODUCES FOAM

WITH a special nozzle and a portable tank of new design, a fireman can instantly transform an ordinary stream of water from a hose into a frothy spray that effectively smothers oil and gasoline fires. Water passing through the nozzle sucks air into the stream, together with a foam-producing solution contained in the tank. One gallon of the solution is said to produce 350 gallons of foam.

No Fooling! ...Modern Movie Thrills are REAL



When you see a crack-up like this on the screen of your movie theatre, don't be too sure that it is faked. Often, the men who make the pictures have real adventures more exciting than the imaginary ones they enact

ON A Mexican plain, two peons and a soldier succumb to wounds as movie cameras grind on battle scenes. Near the Galápagos Islands, in the Pacific Ocean, machine-gun bullets beat off sharks trying to attack an actor during a perilous swimming scene. Off Pt. Barrow, Alaska, two Eskimos, doing their bits for a drama of the arctic perish in a freezing sea. A stunt race driver crashes to his death; an airplane pilot, doubling for a featured player, spins to earth; a cowboy falls amid thundering hoofs, never to rise again.

"It's trick photography," you say, as the thrills unfold in your favorite theater. "That was done in the studio."

We're not faking these big scenes of distant places in Hollywood any more. In the past, a director could tour the world in Griffith Park, a beauty spot in Los Angeles; but today, audiences everywhere know from the newsreels how Mexico, the Galápagos Islands, and Alaska's icy shore look without ever having visited them. They demand realism, and realism usually can be obtained only by going on the ground itself, setting up our cameras, and grinding on the thrills with nature herself for stage manager.

Because the demand for honesty and

beauty has increased steadily during the last ten years, you will find Hollywood's thrill directors in the remotest sections of the world today, directing camera and technical crews and actors gathered up in strange places, actually doing the things which once were faked in the back yards of Los Angeles.

Far from Hollywood, marooned on an ice floe off the Siberian coast, fraternizing with snapping crocodiles in the heart of Africa, buffeted in a small boat in the Pacific, we grind out drama by the foot. We "ghost directors" get the dirty jobs, reap large rewards in pay, and willingly see big-name directors, sitting in easy chairs at the studios, receive the world's acclaim.

Some of us spend more time in the field than at home. Every few days, some director of thrills boards a plane, bound for an obscure spot to determine whether it offers the required background and atmosphere for the particular type of action he seeks. For eighteen years I have been directing scenes in little-known corners of the world. Thirteen men have died before

my cameras, victims of tragic mishaps. I have shot more than 7,000,000 feet of film, of which some 70,000 feet have reached the screen.

Suppose we step behind the scenes a moment. What actually takes place during the filming of these thrillers? We are standing on a tall, wooden platform, known as a camera parallel, near Mexico City. Before us, 4,000 Mexican soldiers and peons stand about in two large groups, ready to take part in a series of battle scenes. Beside me stand 150 members of my staff, brought with me from Hollywood, as well as several score Mexicans who have had army training.

"Ammunition has been rationed, eight rounds to each man," I explain. "Search every actor and extra on the set, and if any carries live ammunition throw him out. Hereafter give out blanks only. I don't want anybody hurt."

For nearly a week after I delivered my warning speech, "rebels" and federals charged each other on the field of make-believe battle, with no casualties. Then we scheduled a series of close-ups showing charges against individual machine-gun nests, cavalry charges, and an execution. The execution came first. Five federal officers, "captured" during battle, were lined

By
RICHARD ROSSON

One of Hollywood's "Ghost Directors" Tells You About the Genuine Adventures and Escapes That Bring Those Spine-Tingling Scenes to the Screen

up and five peons trained their rifles on their breasts at eight paces. All had been searched immediately before the scene. Each had one blank cartridge for his weapon.

From the side lines I directed the placing of lights, disposed the crowd in the background, called for action.

"Ready! Aim! Fire!" shouted the officer in charge. The five rifles spoke as a single piece. Five officers slumped to the ground.

"All right, cut," I said. "Fine scene."

But one of the five men remained motionless. Doctors assigned to the company rushed to his side. They found him dead from a bullet wound through the heart. His executioner, apparently nursing some grudge against federal authority, had shot him down in cold blood. We recalled the five members of the firing squad, but by no word from them or witnesses could we determine in what order they had stood on the firing line, nor how a bullet came to be in the breach of that one rifle.

Troubles certainly seem to multiply once they start. Next morning, I reached the location ready to direct twenty-six Mexican cowboys in a mass "running W," a feat of horsemanship so perilous that it is banned in the United States. Lariats had been laid on the ground, their nooses ready to be jerked up when pounding hoofs were over them, to trip the horses. Riders were coached to take the fall easily, landing on one shoulder and rolling in a tight ball.

"When the bugle sounds," I explained through my interpreter, "the cavalry will

charge that machine-gun nest. Riders will fall over their mounts' necks, land on their shoulders, and roll in a ball. If they follow my instructions, no one will be hurt."

A few minutes later, the bugle rang out. The group galloped at breakneck speed toward the emplacement, and twenty-six riders tumbled to earth and lay still until the bugle sounded "cut." Then all but one arose and walked off.

Charlie Clark, first cameraman, called my attention to the prostrate figure.

"That guy hasn't got up yet, Dick," he said.

Together we walked to the fallen peon, calling for a doctor to join us. He found the man's neck broken from the fall.

On two other occasions, death entered these scenes. A small band of "rebels" engaged the federal troops in hand-to-



Right, the author in the shack he occupied while filming a lumberjack story in the white-pine forests of Idaho, preparing his reports and planning the next day's work schedule



This was a mimic execution filmed for a Mexican war picture, but the officer seen second from the left was actually killed by a real bullet which had been substituted for the blank in one rifle



Standing on a tall parallel, or camera platform, Director Rosson supervises the making of airplane scenes by dare-devil pilots over the Texas plains

hand fighting, using worn-down and dulled machetes as weapons. Two, who we later learned were enemies, sought each other out and settled their differences in real combat. One of them died.

Next morning, another peon, warned not to approach within six feet of a machine-gun, rushed the weapon as it was firing blank shells. Unlike American-made blank cartridges, these were loaded with wooden plugs, which riddled the man as he came within close range.

Three hundred thousand feet of film were exposed on these thrilling scenes, at the cost of four lives, and only 2,000 feet reached the screen.

Technical difficulties while shooting scenes far from Hollywood concern us far less than actual dangers to members of the cast and crew. For five months I bounced around the Pacific on a tuna boat staging shark fights. These culminated in a bloody scene showing an actor swimming through the waves, and being set upon and supposedly eaten by sharks. But,

Below, a marksman hidden behind a blind to guard actors from polar bears while making scenes in the arctic. The two camera boats at the right were filming a whale chase that nearly landed Rossen in the salt mines of Siberia for poaching



since the star neither was physically able nor would have been permitted by the studio to risk his life in the sea, Guy Silva, a young tuna fisherman from San Diego, enacted the role. Daubed with grease paint, he leaped one afternoon from the camera boat and started his perilous swim toward a second boat 200 yards distant. We paralleled his course, possibly 100 feet away.

On the prow of our vessel, a machine gun was mounted. Two lookouts watched both sides for telltale shark fins. Hardly had we got under way when the starboard lookout shouted, "Shark off the starboard bow!" to be echoed by his companion, "Shark off the port beam!" Then the gunner swung into action. He literally inclosed the swimmer in a circle of bullets, widening the circle to beat off the man-eaters.

That shot completed without further incident, we came to the problem of show-

ing the swimmer being torn to pieces by these tigers of the sea. To get quick action, we sewed several large hooks into a man-size dummy and saturated it with ox blood. When the camera crew reported ready, two husky tuna fishermen flung the dummy into the sea, following it with several gallons of ox blood. Attracted by the blood, a dozen sharks sped from near-by feeding grounds and attacked the dummy. Some, caught on the hooks, threshed about in mad efforts to escape. Thus did we obtain an unusually thrilling scene.

Let's jump to the arctic, where I went a few months later to film real close-ups of polar bears and whales for another picture. Within two months I twice escaped the crushing impact of an ice pack, missed a sentence to the salt mines of Siberia by minutes, and was marooned on barren East Cape with a unit of forty-five men for forty days.

Early one morning, we got a harpoon into a big California gray whale, and it headed for Wrangell Island, twisting through the pack ice for seven hours before giving up. Meanwhile, our base ship, the *Nanook*, seeing us between the pack

ice and the island, and noting our danger, radioed the U. S. Coast Guard cutter *Northland*, which rushed to us, warding off the ice until we had finished the kill and shot our scene.

We didn't know we were poaching as we drew closer to the Siberian coast. They told us aboard the *Northland* that the penalty for poaching up there is an automatic sentence to the Siberian salt mines, regardless of the poacher's nationality or purpose, and that only the sudden appearance of the cutter prevented our seizure by a Russian gunboat.

Sometimes we load our equipment on a steamer or into an airplane and depart for a location we have never seen. There conditions of weather and topography may necessitate a complete rewriting of the script, the building of a town, stalking of wild game, or fighting blazing heat or raging storms.

One director paid \$3,000 to an aviation concern merely to fly his cameras, generators, and radio equipment across Alaska. Neither he nor his assistants had seen the location until they were landed on the ice three miles from shore. There he unloaded 1,500 pounds of camera and accessories and struggled with them across jagged ice to a near-by village.

During the [\(Continued on page 124\)](#)



The author directing lumberjacks in a breath-taking sequence showing the breaking up of a log jam in a northwestern river. When the logs started moving, the cameramen had to stop work and take a hand in rescuing the imperiled men from the grinding mass, after filming some unintentional drama

Placer Miners Wash *Sapphires* from Montana Hills



A miner examining a shovelful of gravel from the flume, while another sifts the mixture for gems



This ditch carries silt to the flume where the valuable stones are caught by a series of riffles, or crosspieces

HIGH in the Sapphire Mountains of western Montana is one of the strangest mines in the country. There, seven men armed with shovels literally scoop up most, if not all, of the sapphires mined commercially in the United States.

Although sapphires are found in many sections of the West, a series of gulches extending some two miles along the bank of Rock Creek, near Phillipsburg, Mont., is practically the only place where they occur in paying quantities. Here most of the stones lie on bed rock, where they have settled during the past ages, buried beneath six to twelve feet of overlying earth and gravel.

Using old-time placer methods, a single company conducts the mining operations. Miles of ditches, flumes, and pipes carry water to the hydraulic nozzles. Their 400-pound-pressure streams bore into the earth and direct the silt to a crude ditch carved out of the solid rock; this leads to a flume studded with riffles or narrow crosspieces to catch the valuable stones. When the bed rock has been laid bare, the miner spreads the stream of water fan-wise with his thumb and "sweeps" the loose gems into the flume where the riffles trap them.

Once a day, the mining ceases and most of the water is shut off. A miner lifts out a section of the riffles, while another removes the valuable mixture of gravel and sapphires by the shovelful. Each day's "take" goes into a large box such as street



Thrusting his thumb into the jet of water, the miner sweeps the loose gravel down the ditch

and building contractors use to store tools. The final step is to remove the gravel by sifting, and to separate the precious from the common stones.

Most of the stones are clear and colorless, but when seen in a heap they appear a very light green. Occasionally, blue stones of various shades are found, and sometimes a yellow, pink, or red one turns up. The largest and choicest of their finds the miners send to the jewelry markets to compete with imported sapphires from Burma. The rest go to meet the great industrial demand for the stones. Because sapphires are second only to diamonds in hardness, they are prized as jewels for

watches, as points for phonograph needles, as abrasives, for wire-drawing dies, and in many other industrial uses.

Since water pressure is their most important tool, the miners can work only four or five months of the year, when water is plentiful. However, in spite of their short season, they wrest more than seven tons of sapphires from the earth annually.

When mining operations are not in progress, the company utilizes its valuable land by grazing cattle and raising hay on the lower reaches. All lumber used in the flumes and other construction is cut from the jewel-bearing hills.

Science Remakes



A prize-winning Sealyham, one of the smaller breeds of dogs that lately have won popularity

DOGS are getting smaller. Subject to style trends, the same as clothing, automobiles, and houses, they are adapting themselves—or, rather, being adapted—to the changed conditions of modern life.

People today are demanding dogs that can live in small homes or apartments, and ride in automobiles, without crowding out their human companions; dogs that can keep fit with a minimum of exercise; smart, good-natured dogs, and—an important consideration, sometimes—dogs that will not eat their masters out of house and home.

To meet these new requirements, breeders are applying scientific principles of heredity in bringing out the desired qualities. Already, the appearance and character of the nation's dog population show the effects of their work—a modern version of the unceasing process which, in the past, has had such amazing consequences as the refinement of the popular Airedale terrier from a mongrel, the conversion of the strain of wolflike spitz into the little toy Pomeranian, and the development of the bulldog into an animal vastly unlike his bulldog ancestors of a century ago.

Largely as a result of the demand for smaller dogs, the Boston terrier, one of the only three breeds actually originated in the United States, today leads all others in American Kennel Club registrations. Next come three other small breeds, the cocker spaniel, the wire-haired fox terrier, and the Scottish terrier. As recently as 1926, the German shepherd, often loosely called a "police dog," ranked first; but it is now in twentieth place, possibly because the depression made owners more conscious of the cost of dog food.

Through selective breeding, experts have been meeting the demands for smaller dogs, dogs which eat less and can be kept more economically; dogs which need less exercise, and therefore retain better health in cramped quarters. The motor age has restricted the exercise of dogs even more than that of men. It has created a need for breeds which remain in good physical condition when they are walked only on a leash, or

at best in close company of their owners, instead of being allowed to run free. Thousands of motorists want dogs adapted to riding in cars instead of to loping for miles alongside horse-drawn coaches.

These changes, occurring now among pedigreed dogs, are by no means limited to that select group. Within a few years they will be reflected by the general dog population of the country. It is estimated that there are in the United States between 500,000 and 1,000,000 purebred dogs, and 15,000,000 or more mongrels; and nearly all their owners are affected by similar conditions.

The mongrels themselves gradually show effects of crossing with whatever pure breeds happen to be most numerous. Look around, and you will see that the "average" dogs today ex-

hibit definite marks of the German shepherd or the Airedale, whose popularity swept the country in recent years. There are numerous inheritances too, from the collie and the bull terrier, while the bird-dog influence is especially strong in the smaller communities. Early in the century, there were widespread traces of the fawn-colored, looptailed pug, but most of them have been lost in the engulfing tide of other blood.

IMAGINE HIM IN AN APARTMENT!

Big dogs, like this Irish wolfhound, are out of place in the modern world. This fellow is nearly eight feet tall standing on his hind legs as shown



A new dog, the affenpinscher or "monkey dog"



the DOG

*How Breeders Are Changing
The Appearance and Nature
Of Our Canine Population
To Bring Out the Qualities
That Are Made Desirable
By Modern Living Conditions*

By
JESSE F. GELDERS

Being no snob in the matter of dogs myself, and having an equal fondness for pure-breds and others, I inquired of Kennel Club officials why every cross-bred is termed a mongrel. The distinction, I learned, is based not on snobbery, but on scientific fact.

When pure-bred dogs of the same breed are mated, the puppies are like the parents. But when two different breeds are crossed, even though both dogs are of the purest strains, the characteristics of the puppies cannot accurately be foretold.

A breeder told me of the chance mating of a Scottish terrier and a hound, from which five pups were born, with ears like hounds and bodies like Scotties. What *their* puppies would be like, nobody could guess. For when mongrels are mated, even two mongrels of exactly the same appearance, their pups may be entirely different, taking a new combination of characteristics from their ancestors. Once there is a mixture, only long, careful breeding can sift out and stabilize any definite type.

Heredity is so certain to play pranks, that kennel clubs refuse to register any dog as a pure-bred unless its ancestors are known for

A blue-ribbon cocker spaniel. Originally a hunting dog, the cocker was bred smaller to make him a good pet



Blue bloods of dogdom—three-month-old Boston terriers. This breed now leads all others in American Kennel Club registrations

three generations. On the rare occasions when a new breed is to be recognized, proof is required that there has been no variation from the proper type, either in three generations of direct ancestors, or in any pup born in the same litter with any of them.

Breeders seeking dogs of new types for definite new purposes usually have a choice of two procedures. They may cross breeds, as a chemist compounds elements to obtain a new material, but this is a long and uncertain task. On the other hand, they may "refine" an already existing breed, taking dogs which are a little closer than the average to the type they want, and continuing the selection until the entire strain takes on the new, desired qualities.

By such processes, the Scottie has changed his appearance in the last twenty years, developing a more profuse coat, a squarer head, and a shorter body.

The cocker spaniel, originally a hunting dog and one of the first breeds in the American colonies, has since been bred smaller as a pet, and is now being guided back to greater size again, to be used for hunting.

The bench-show setters, bred for their looks, have changed so greatly that they almost have the appearance of a different breed from the field-trial setters, developed for speed and good noses.

Even before the principles of heredity were studied scientifically, breeders unconsciously made use of them, by patiently selecting dogs with the traits they desired to reproduce.

There was the case of Polaris, the North Greenland Eskimo dog, whose sled-pulling ancestry gave him such an aptitude for the work that on his first

introduction to the harness he pulled a heavy sled three miles through deep snow.

The breeder of sheep-herding collies developed such intelligence in the animals that a dog could go alone and select his master's sheep from the others grazing in the hills, bring them home, and separate the rams from the ewes and lambs before driving them to their quarters.

The short-legged Welsh corgi was bred to do a job of a different sort. He scattered his master's cattle on the public grazing ground by nipping at their hocks, and when they kicked he had to dodge. In this risky work, his low stature often saved his life. With intelligence specially cultivated for *(Continued on page 126)*



The Pomeranian, a favorite in the toy class



The wire-haired fox terrier, left, has come into his own with the vogue for small dogs. Below, the bulldog's gentle nature belies his cultivated ugliness



FOUR-IN-ONE PLANE CHANGES WINGS TO SUIT PURPOSE

FOUR PLANES in one is a craft just entered in a U. S. Army Air Corps competition for advanced training machines. Interchangeable wings enable the convertible plane to be adapted within a few minutes for use as a "primary," "basic," or "advanced" trainer, or as a speedy and comfortable air cruiser for staff use in cross-country trips. With its wings shortened, its landing gear retracted, and its 550-horsepower motor at full throttle, the new model is declared to be equal in performance to present-day pursuit planes.



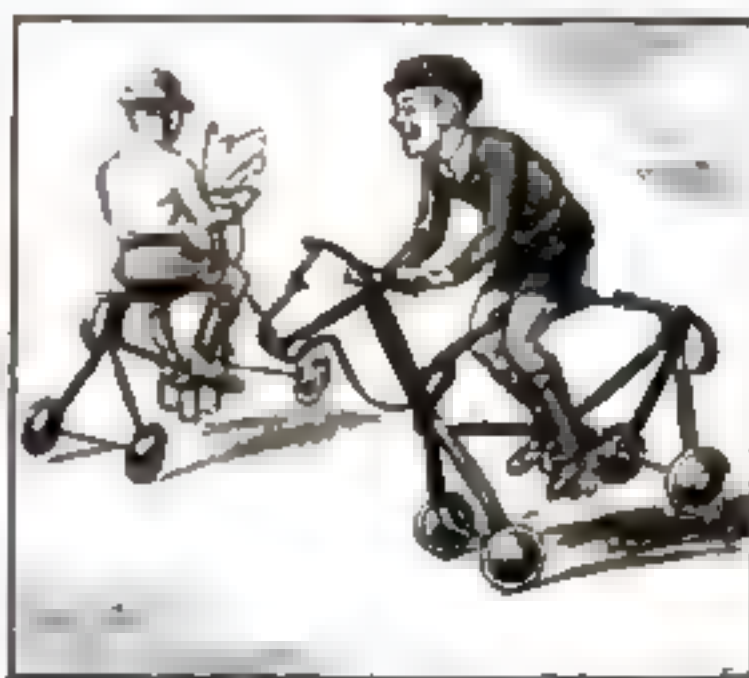
Convertible Army training plane in one of the four rôles it can assume by wing changes and other simple adjustments

HOBBYHORSE REALLY GETS SOMEWHERE

WHEN a child jumps up and down in the saddle of a hobbyhorse of new design, the mechanical steed carries him forward several feet with each bounce. The secret of the ingenious motion lies in a locking mechanism that enables the rubber-tired wheels to move frontward only. Each jounce compresses the spring frame, exerting a forward kick against the movable front wheels and a backward kick against the locked rear wheels, and thus propelling the whole vehicle ahead.



A spring action and locking mechanism make this hobbyhorse move forward when the child bounces up and down

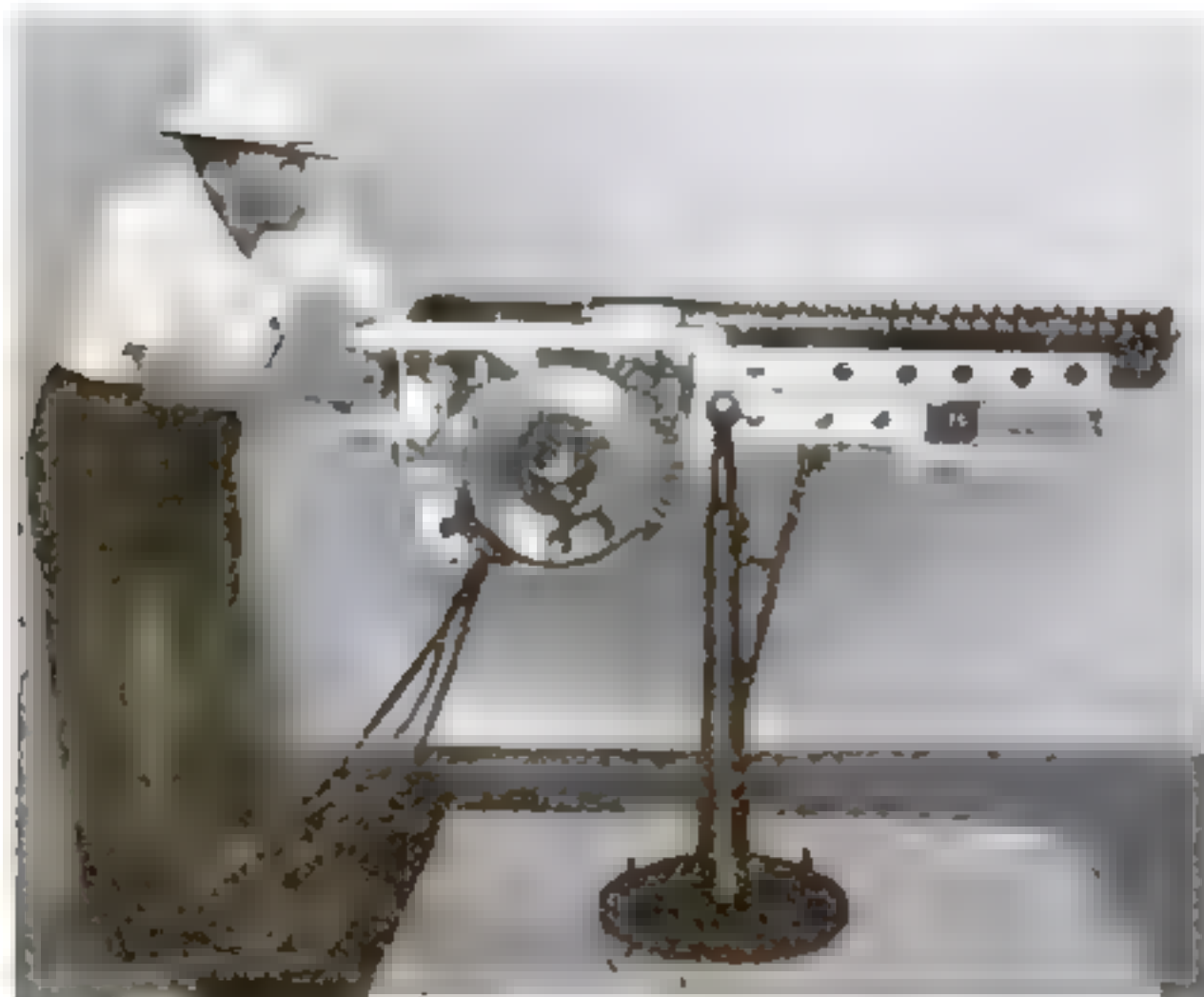


STOP LIGHT ON FENDER HELPS PREVENT CRASHES

TO PREVENT collisions at highway intersections, a Melrose, Minn., inventor proposes installing stop lights on the front fenders of cars. Like a rear stop light they would flash on automatically when brakes were applied. Thus, a driver nearing a crossing could tell whether a car approaching from a side street was going to stop. If its stop lights showed, he could safely proceed; if they did not, he could apply his own brakes.

ELECTRIC MACHINE GUN IS SILENT

ELECTRICITY replaces gunpowder in a silent, smokeless, machine gun recently perfected for defense against hostile aircraft. Without betraying its location, this weapon is declared capable of firing 150 bullets or high-explosive shells a minute. Projectiles are hurled from its muzzle by a series of electromagnets spaced along the barrel, which start the missile moving and successively raise its velocity as they become energized.



Electric antiaircraft machine gun. Electromagnets hurl bullets



W. O. Tatman with the five-eighths-horse power Diesel engine he built

BUILDS TINY DIESEL ENGINE

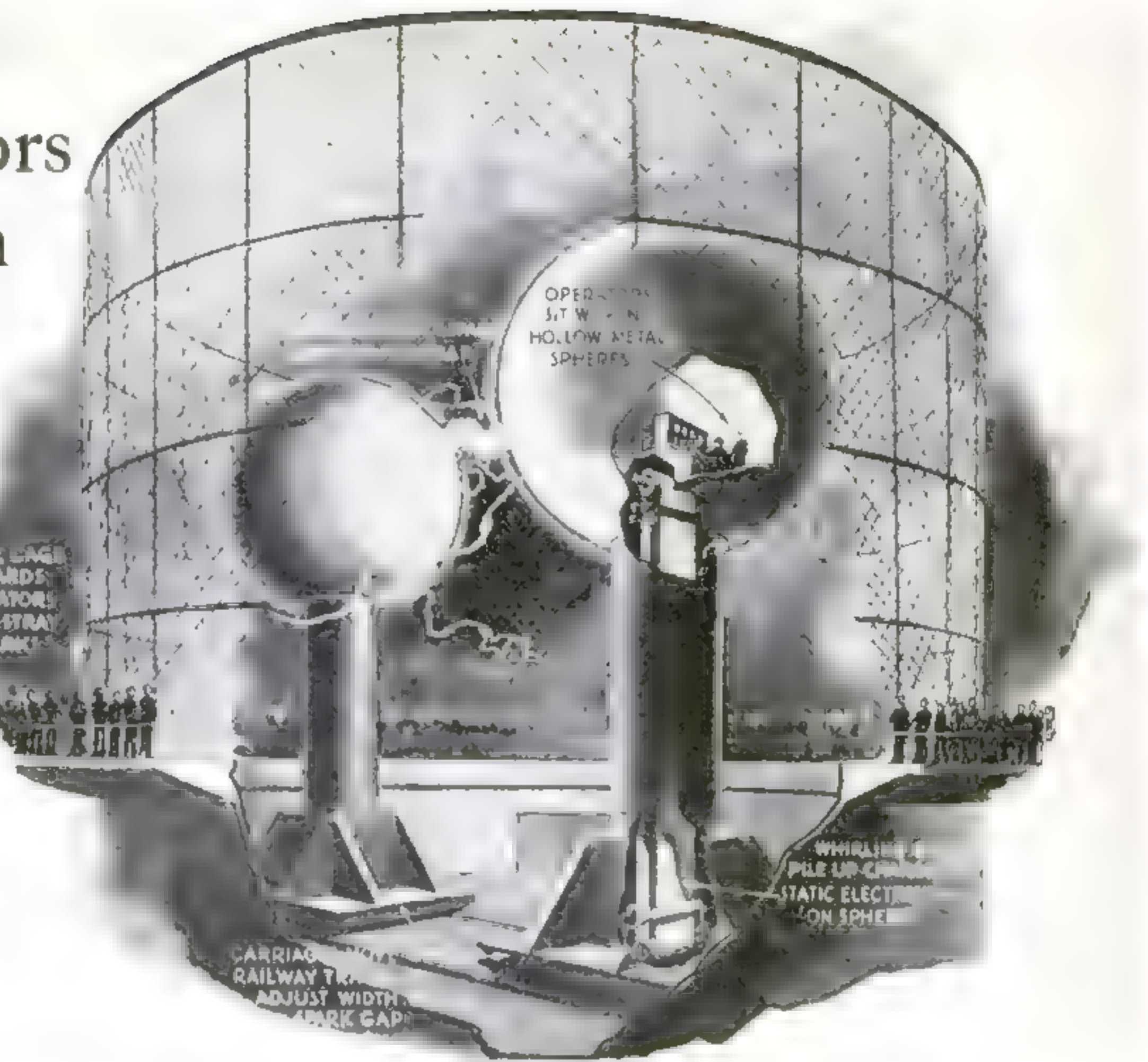
WHAT is called the world's smallest Diesel engine has been built by W. O. Tatman, Los Angeles, Calif., engineer. The midget power plant is ten inches high, weighs thirty-five pounds, and develops five eighths of a horsepower.

Giant Sparks To Thrill Visitors At Exposition

PEERING into a cylindrical cage eighty feet in diameter and equally tall, visitors to the international exposition at Paris, France, next summer, will see one of the world's most powerful high-voltage electric generators in action. Ten-foot-long sparks will snap between huge brass spheres mounted on insulating pillars, with a sound like the cracking of a giant whip. Should any of the sparks go astray, they will be harmlessly grounded by the metal cage, which safeguards the spectators from their terrific power. Operators will control the spectacular display from within the hollow spheres, where, strangely enough, they will be equally safe.

In principle, the Paris machine will resemble a monster high-voltage generator already in operation in a dirigible hangar at Round Hill, Mass. (P.S.M., Jan., '32, p. 19). Endless belts of rubberized cotton, whirling within the pillars at mile-a-minute speed, will pile up charges of static electricity upon the metal spheres. When a 5,000,000-volt potential is reached, the discharge will occur.

Behind the unusual exhibit lies a romantic story. The super-generator has long been the dream of Mme. Irene Curie Joliot, daughter of the discoverers of radi-



Our artist depicts the 5,000,000-volt generator as it will appear while on exhibition at Paris next summer

um, and her husband and scientific collaborator, Prof. Jean Frederic Joliot, who startled physicists two years ago by announcing the artificial production of radioactivity. Just such a machine was needed to pursue their experiments in making

artificial radium, but funds to build it were lacking. Then the idea occurred to them of exhibiting it at the fair in order to pay for it. After the exposition, the powerful generator will be moved to their laboratory for the important research work.



This "neck pillow" eases the strain of jouncing over rough roads in the rear seat of a car

AUTOMOBILE SERVES AS STAMP ALBUM

BY MAKING the exterior of his car serve as his album, E. Hadley, of Casper, Wyo., has assembled one of the world's strangest postage-stamp exhibits. Five girls worked for six weeks to plaster the machine with the 10,000-odd specimens, which are covered with a protective coat of varnish to shield them from the weather and hardships of the road.



E. Hadley, of Casper, Wyo., with his rolling stamp collection. More than 10,000 specimens are plastered on the automobile's exterior

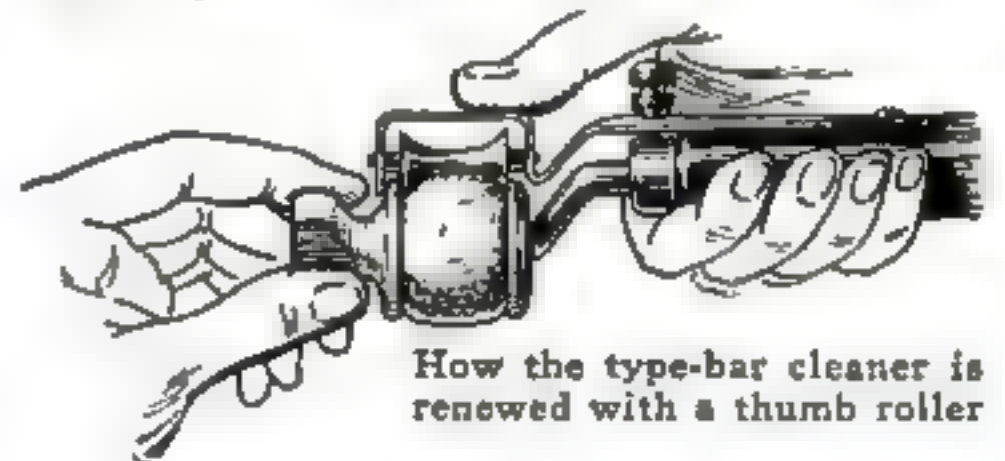
PILLOW FOR MOTORING FITS AROUND NECK

MOTORING comfort for rear-seat passengers on long cross-country tours is assured by a pillow of new design, which fits around the neck of the wearer and eases the constant strain of jouncing over rough roads, as illustrated in the photograph at the left. According to the maker, the "neck pillow" also serves as a restful accessory for travelers by bus and train, and can be put to use in hospitals by invalids and in the home by comfort-loving individuals.



PLASTIC ROLLER CLEANS TYPEWRITER BARS

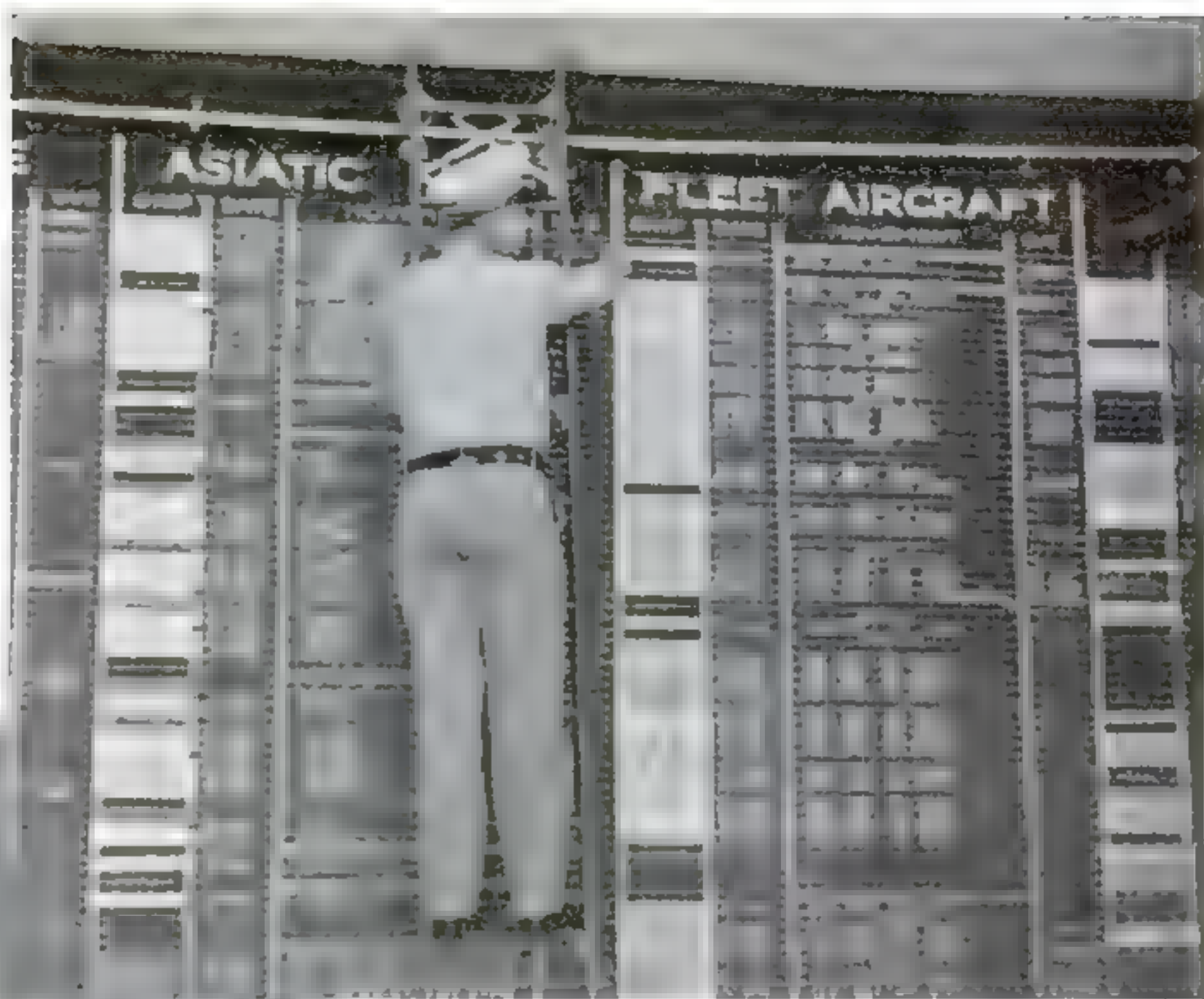
CLEANING the type bars of a typewriter becomes an easy task with the aid of a handy new tool. The implement provides a cylinder of plastic material that is rolled across the type under slight pressure, leaving the characters fresh and clear. To recondition the tool for subsequent use, it is necessary only to press a thumb roller against the absorbent material and rotate the latter by means of a convenient key. This exposes a fresh surface.



How the type-bar cleaner is renewed with a thumb roller

Navy's Roll Call

KEEPS TRACK OF
Far-Flung Fighting Ships



On this board in the Navy Building at Washington, D. C., every one of Uncle Sam's war vessels is listed, with its location, destination, and time of arrival

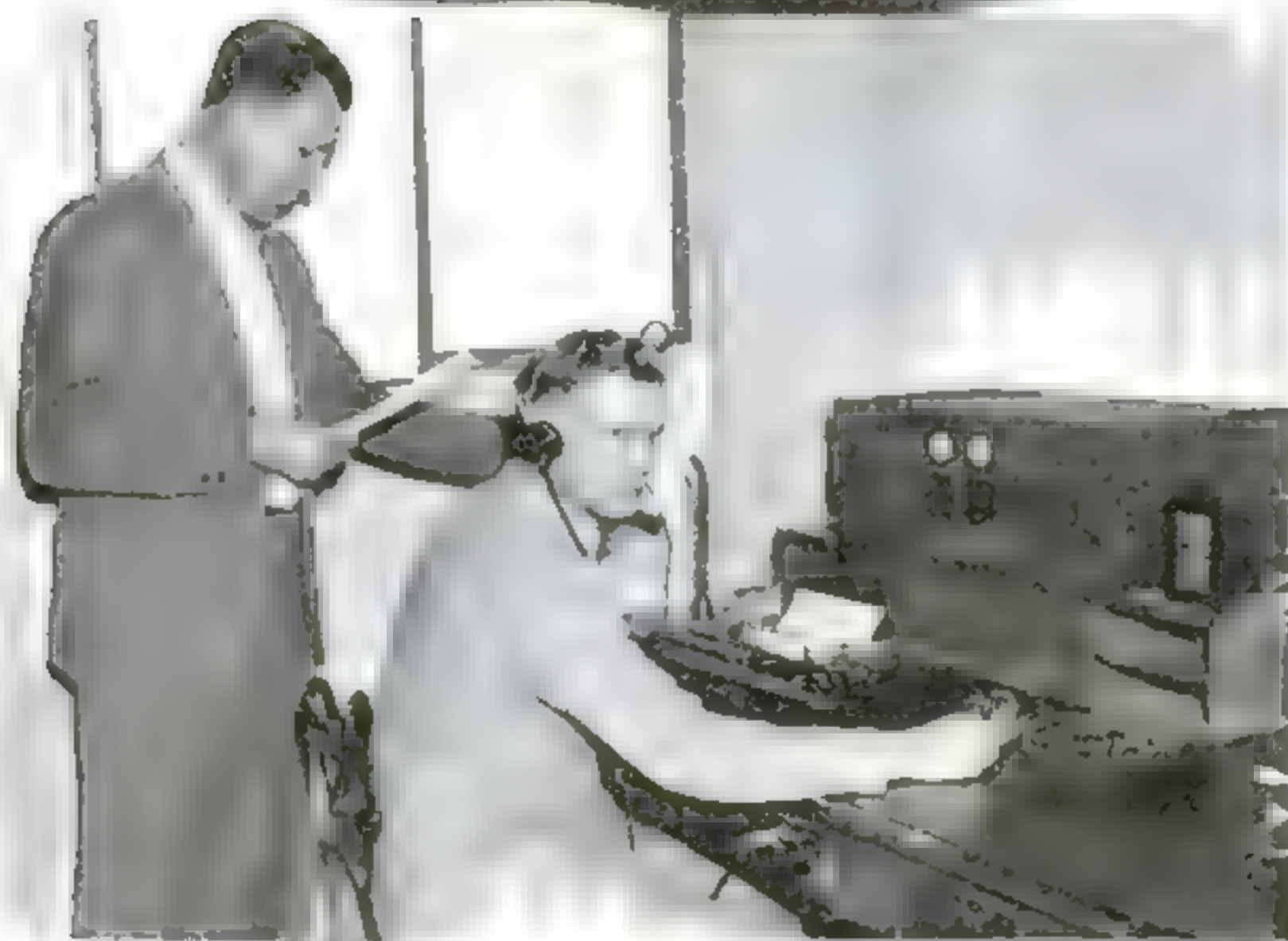
WHEN trouble starts in Spain, Cuba, China, or any other spot on the globe, and the safety of American citizens demands the dispatch of war vessels to the scene, how does the U. S. Navy decide which ships to send? The answer lies in a room, about forty feet long and thirty feet wide, on the second floor of the Navy Building, at Washington, D. C., where alert "dispatchers" keep track of the wanderings of Uncle Sam's 300 active war craft.

Three sides of this room are covered with a gigantic blackboard. At first glance, it suggests the train-schedule board familiar to railway travelers. It is known officially as a ship-movement board. Vertical rows of hooks hold metal strips upon which the names of battleships, destroyers, cruisers, submarines, and aircraft are printed. As reports of a vessel's position come in by radio, notations are made in chalk opposite its name on the board. Its location, its destination, if it is under way, and the expected time of its arrival are all recorded. Thus, officials are able to tell at a glance the exact position of every ship in the navy.

The names on the board are placed under four headings. The first group is the Battle Force; the second, the Scout-ing Force; the third, the Submarine Force; and the fourth, the Base Force. Under these four headings are listed all the sea and air craft which may be needed in an emergency.

When the recent Spanish civil war broke out, the ship-movement board showed that the battle-ship *Oklahoma*, and the cruiser *Quincy*, were nearest to the scene. The *Oklahoma* was at Cherbourg, France, and the cruiser was nearing the coast of Europe on a shakedown cruise. Both ships were ordered immediately to the trouble zone to evacuate imperiled Americans.

Even when no hostilities threaten citizens abroad or at home, the black-board-lined walls of the Washington room provide a valuable service to the men of the U. S. Navy. They not only aid in dispatching official mail, but they help in forwarding faultily addressed letters from relatives and friends to the personnel of naval ships which may be anywhere on the high seas heading for distant ports, or lying at anchor in peaceful harbors on the opposite side of the world.



Radio operator receiving a message telling the location of a ship. The information is forwarded to the ship-movement room by pneumatic tube as shown at left

Right, the Navy's post office. Official mail is addressed correctly to far-away vessels with the aid of the ship-movement board, and misdirected letters for sailors are readressed



Un-Natural History

By
GUS MAGER

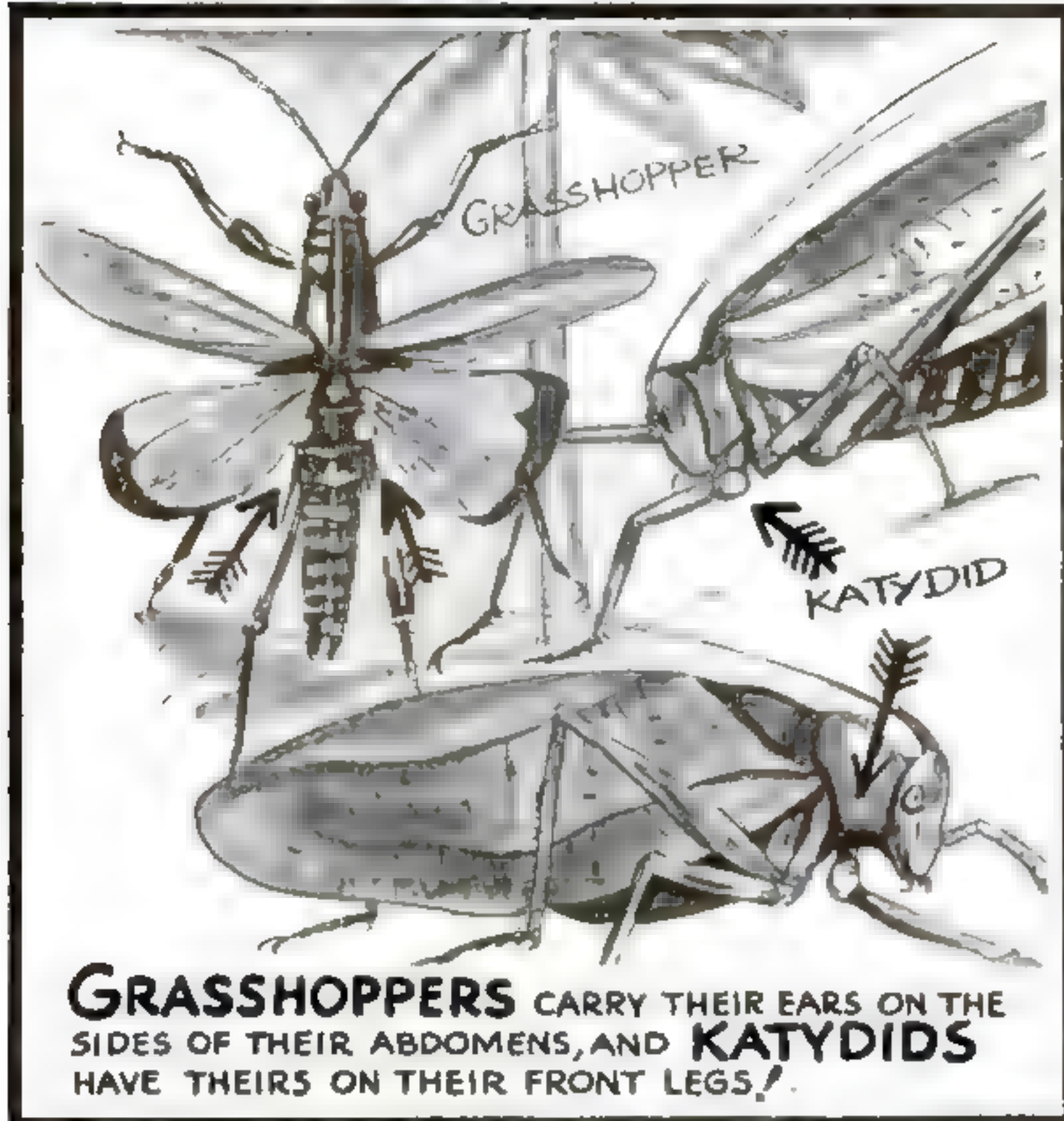
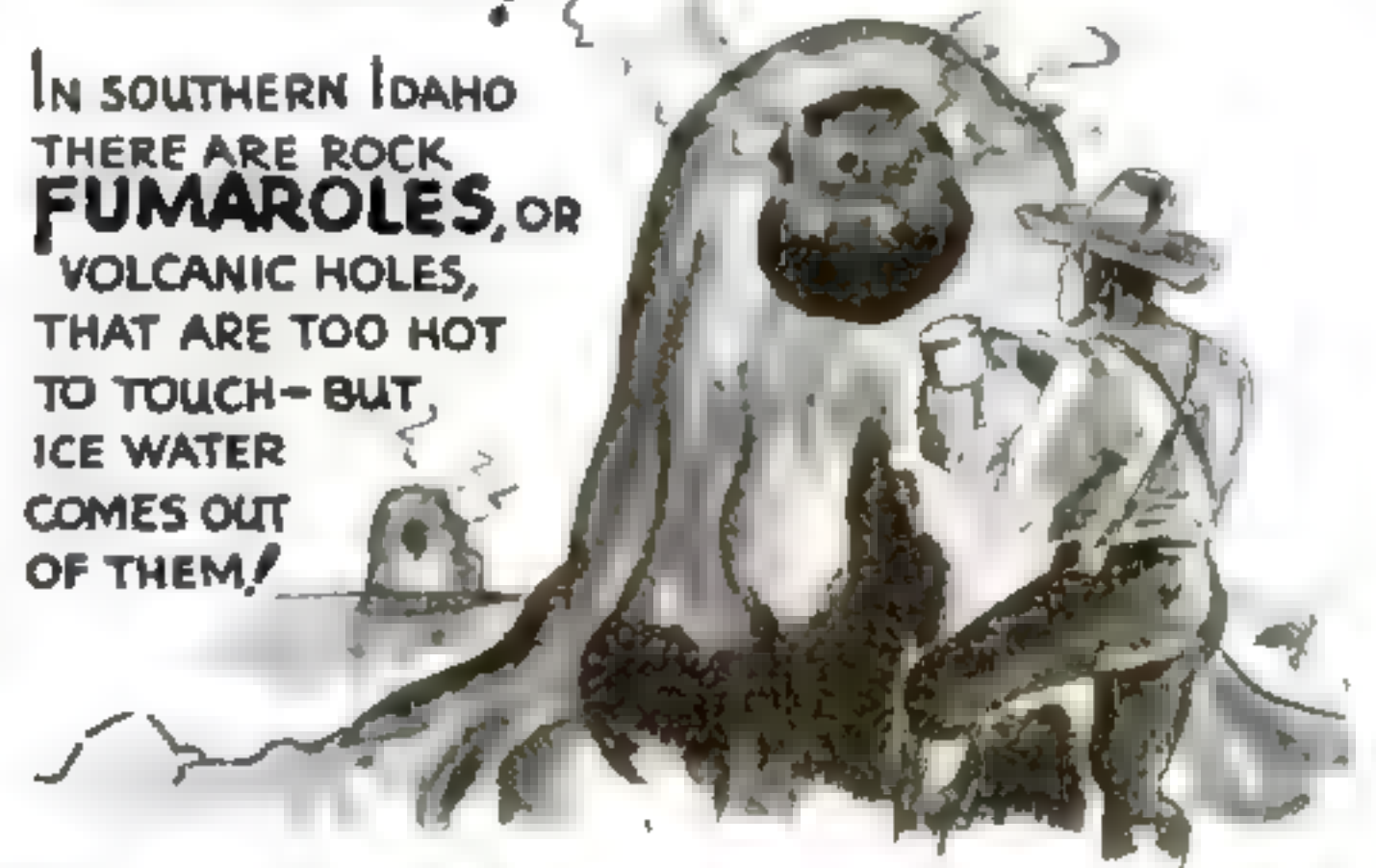


ALTHOUGH THE **BANANA** PLANT PRODUCES FRUIT IT HAS NO SEEDS THAT WILL GROW WHEN THEY'RE PLANTED! THERE WAS A TIME WHEN IT NEEDED SEEDS TO REPRODUCE ITSELF, BUT IT HAS SINCE LEARNED TO SEND UP SHOOTS FROM UNDERGROUND ROOTSTOCKS!



THE **TREE KANGAROO**, ANOTHER FREAK FROM NATURE'S TOPSY-TURVY CONTINENT, AUSTRALIA, DEPARTS FROM THE STRICTLY TERRESTRIAL HABITS OF THE OTHER MEMBERS OF ITS FAMILY!

IN SOUTHERN IDAHO THERE ARE ROCK **FUMAROLES**, OR VOLCANIC HOLES, THAT ARE TOO HOT TO TOUCH—BUT, ICE WATER COMES OUT OF THEM!

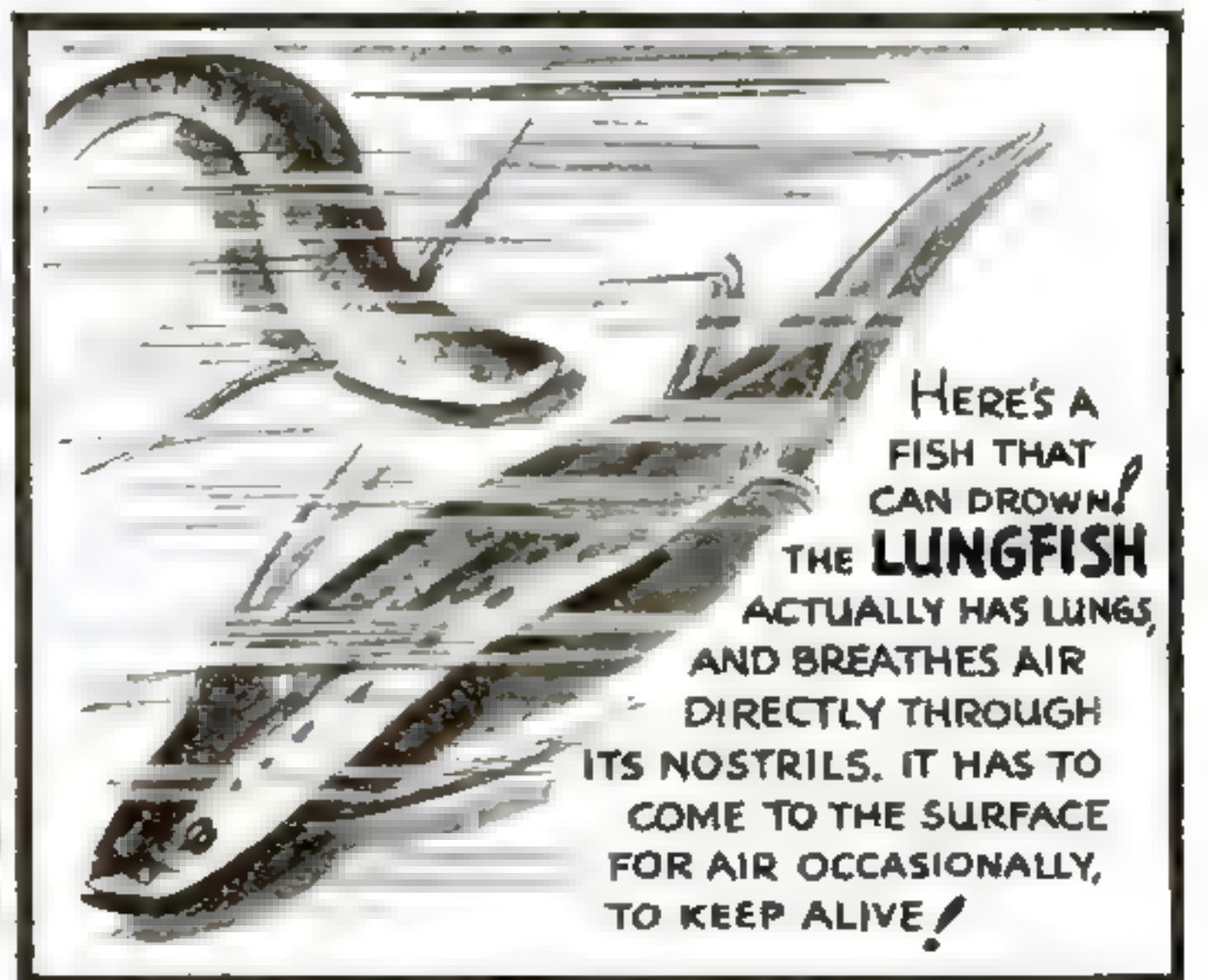
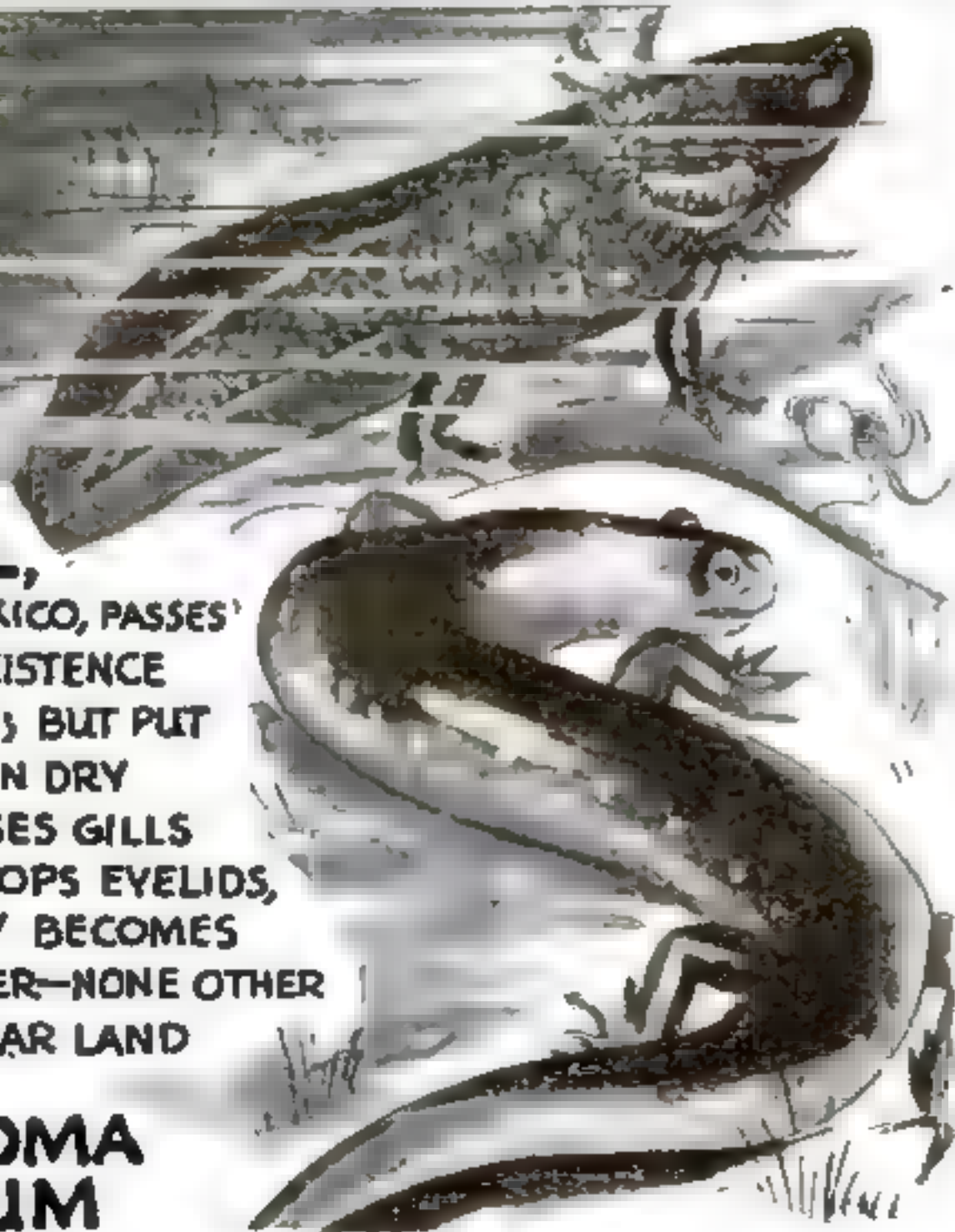


GRASSHOPPERS CARRY THEIR EARS ON THE SIDES OF THEIR ABDOMENS, AND **KATYDIDS** HAVE THEIRS ON THEIR FRONT LEGS!

TALK ABOUT LEADING A DOUBLE LIFE!

THE **AXOLOTL**, A NATIVE OF MEXICO, PASSES A TADPOLELIKE EXISTENCE IF LEFT IN WATER; BUT PUT THE CREATURE ON DRY LAND AND IT LOSES GILLS AND FINS, DEVELOPS EYELIDS, AND GRADUALLY BECOMES A LUNG-BREATHER—NONE OTHER THAN THE FAMILIAR LAND SALAMANDER

AMBYSTOMA TIGRINUM



HERE'S A FISH THAT CAN DROWN! THE **LUNGFISH** ACTUALLY HAS LUNGS, AND BREATHES AIR DIRECTLY THROUGH ITS NOSTRILS. IT HAS TO COME TO THE SURFACE FOR AIR OCCASIONALLY, TO KEEP ALIVE!

Your MICROSCOPE as

*Magic Lenses Enable
Many Tasks With More*



With this simple microprojector set-up, the home craftsman can make examinations of screw threads, model parts, and other objects in the shop

By Morton C. Walling

PEOPLÉ who consider the microscope as a laboratory instrument used only by highly trained scientists and by amateur biologists, would be surprised to know the extent to which it is employed in the machine shop, at the factory bench, in the field, and in connection with the machine tools of countless industrial plants. Much of the present-day precision that is involved in the making of all manner of things, from bolts to battleships, is possible only because the microscope has become a shop tool.

The amateur microscopist frequently is also the owner of a home workshop; or he works in a garage, machine shop, or other place where the magnifying power of glass lenses might have a magic effect, and enable him to do better work than he possibly could turn out with the unaided eye.

A compound microscope of the type used by amateurs can be put to many uses in the workshop without altering it in any way. Magnifications generally required seldom exceed 100 diameters. The jobs such a microscope will do include the identifying of wood, examining of metal surfaces to see how well they are polished, identifying metals by their crystalline structure, examining minute cracks or fractures in metal, checking the cutting edges of tools, and examining paint and lacquer finishes on wood and metal.

For most of this work you will need, in addition to the microscope, some glass slides, cover glasses, balsam, a sharp cutting tool such as a safety-razor blade equipped with a handle, and a source of illumination that can be adjusted for

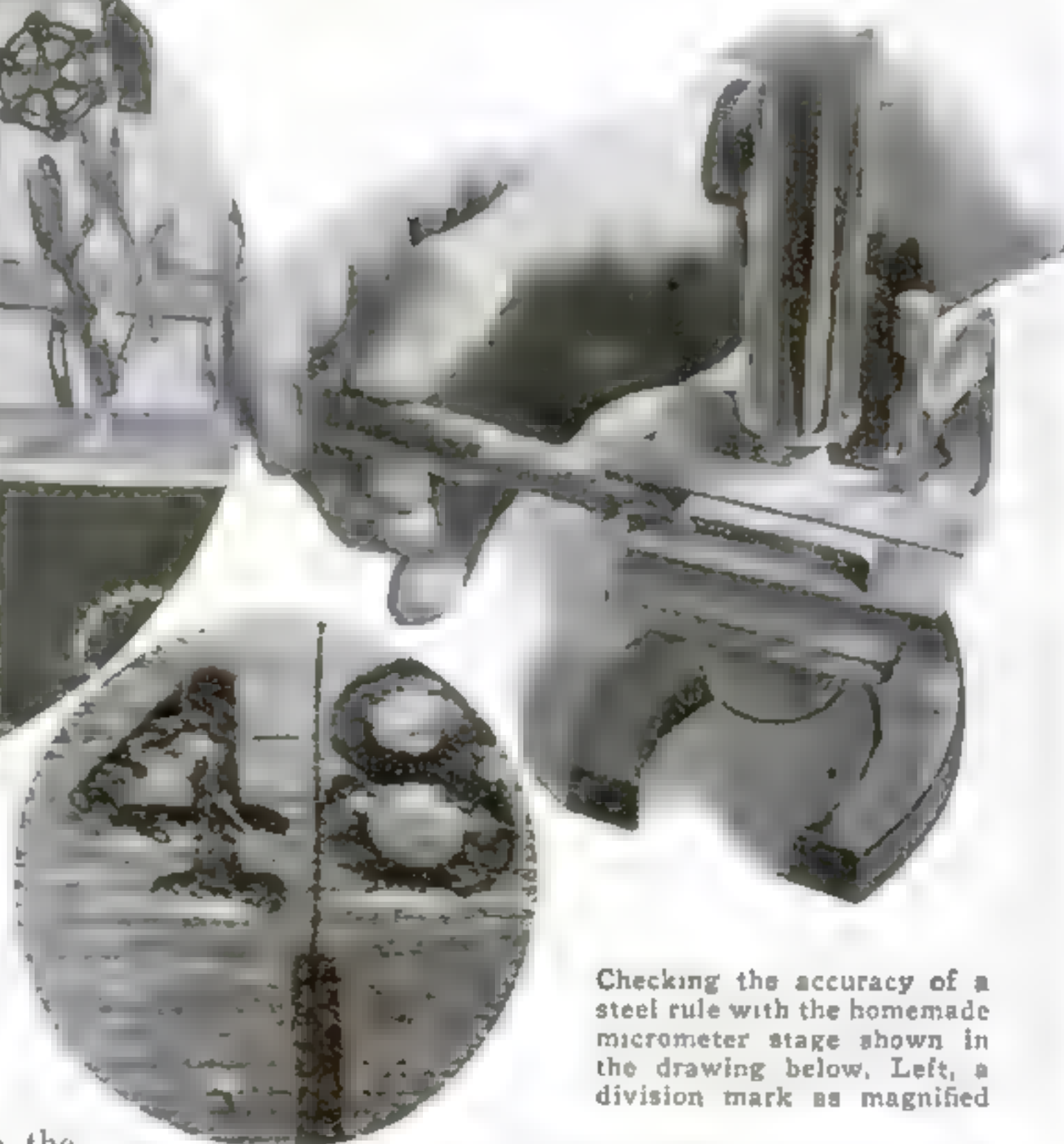
throwing light either on the substage mirror or on top of the object being examined.

The identification of wood is something that the craftsman who works in this material, particularly if he employs the rare imported woods, must be able to do. There is no more certain way of making such identifications than by means of a microscope.

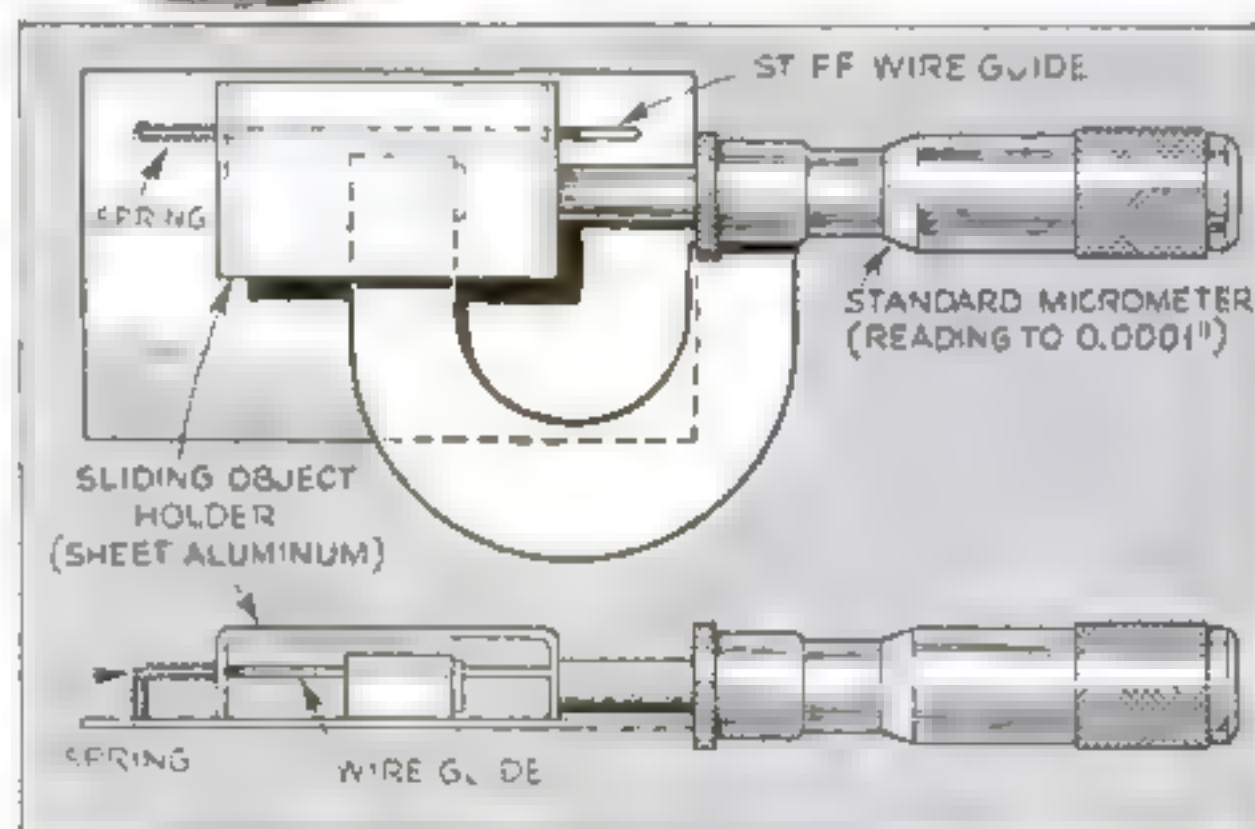
In nearly all cases, an examination of the cross-section appearance of the wood will suffice. This shows the structure and arrangement of the cells making up the wood. Sometimes it is helpful to examine thin, longitudinal sections of wood, so that the sides of the cells instead of their cut ends are seen.

When you look at a thin cross section of wood, you see a series of curved layers formed by the annual growth of the tree, or, if the specimen is a small, woody stem, concentric rings.

In addition, you will see radial lines of cells extending more or less perpendicularly to the rings. These are the medullary rays. Then there may be other distinguishing details, such as the resin ducts in white pine and the extremely large cells scat-



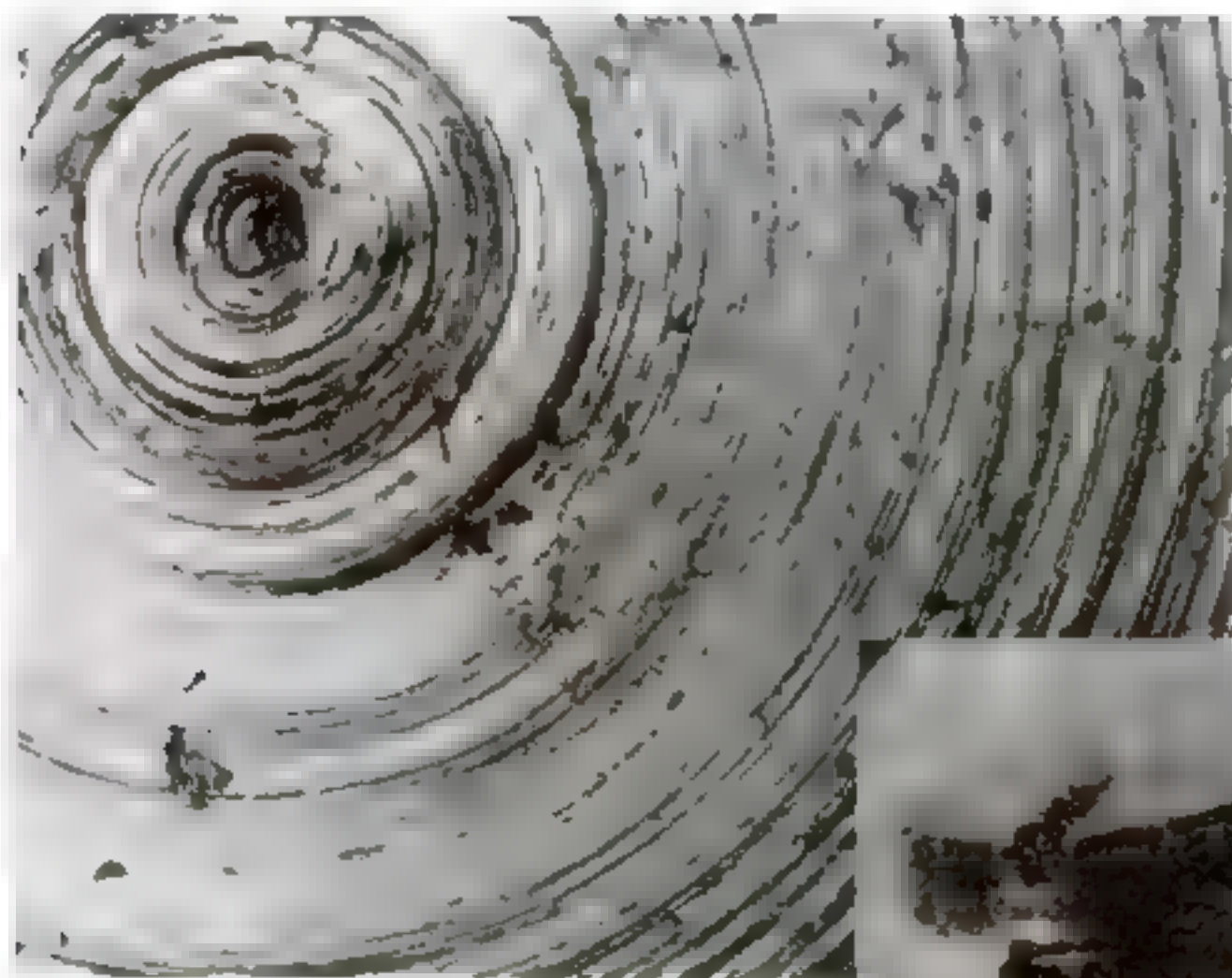
Checking the accuracy of a steel rule with the homemade micrometer stage shown in the drawing below. Left, a division mark as magnified



Samples of wood under the microscope. Above, a cross section of white pine, showing a resin duct and the division between fall and spring growths. Right, walnut; dark lines are medullary rays

a Shop Tool

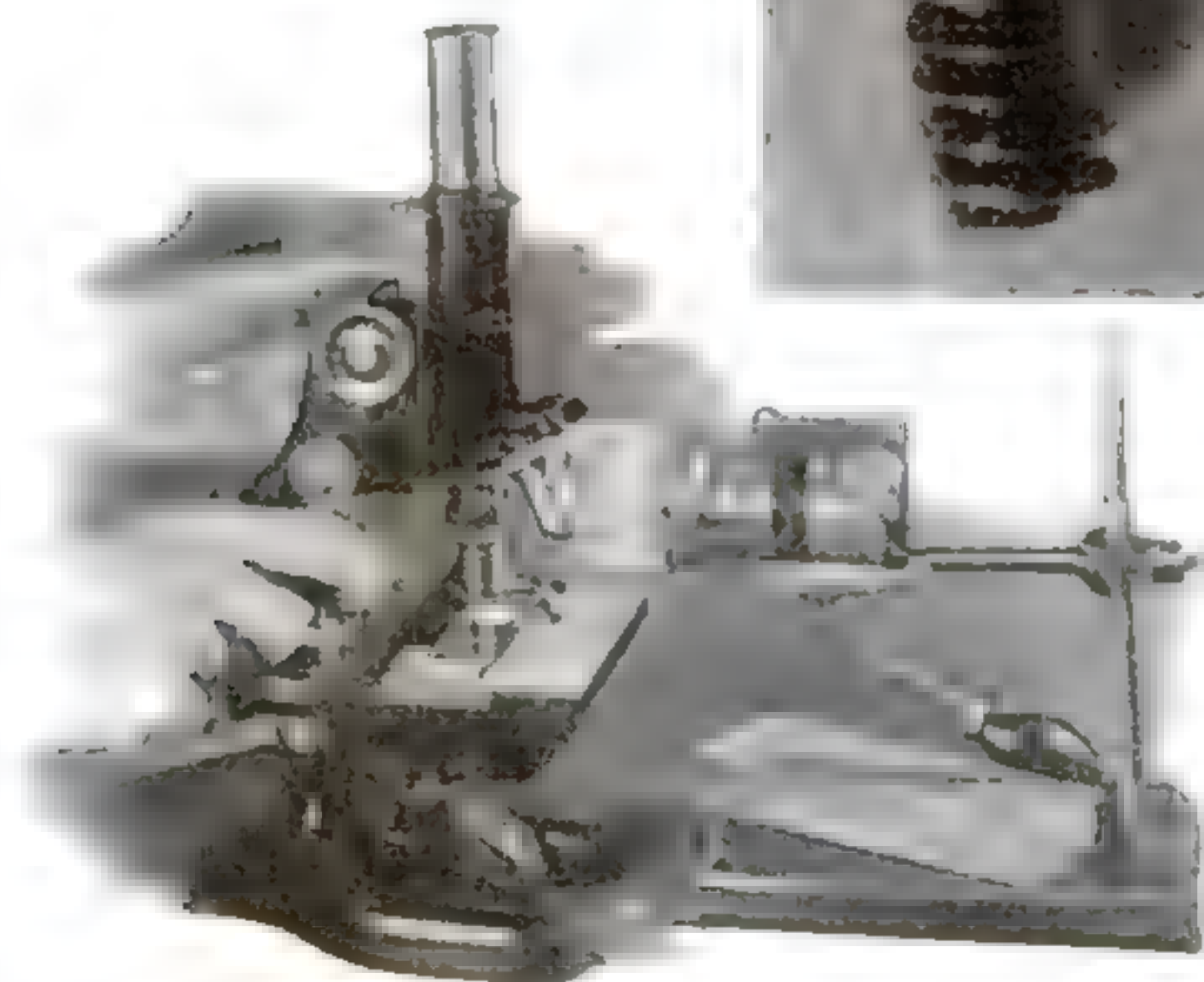
*Home Craftsmen To Perform
Ease and Greater Accuracy*



Lathe-tool marks on the end of a turned metal shaft, as seen through the microscope. Below are two tiny screws from a watch, (shown actual size in small circle) magnified for an examination of their threads. The larger of the two is 0.072 inches long

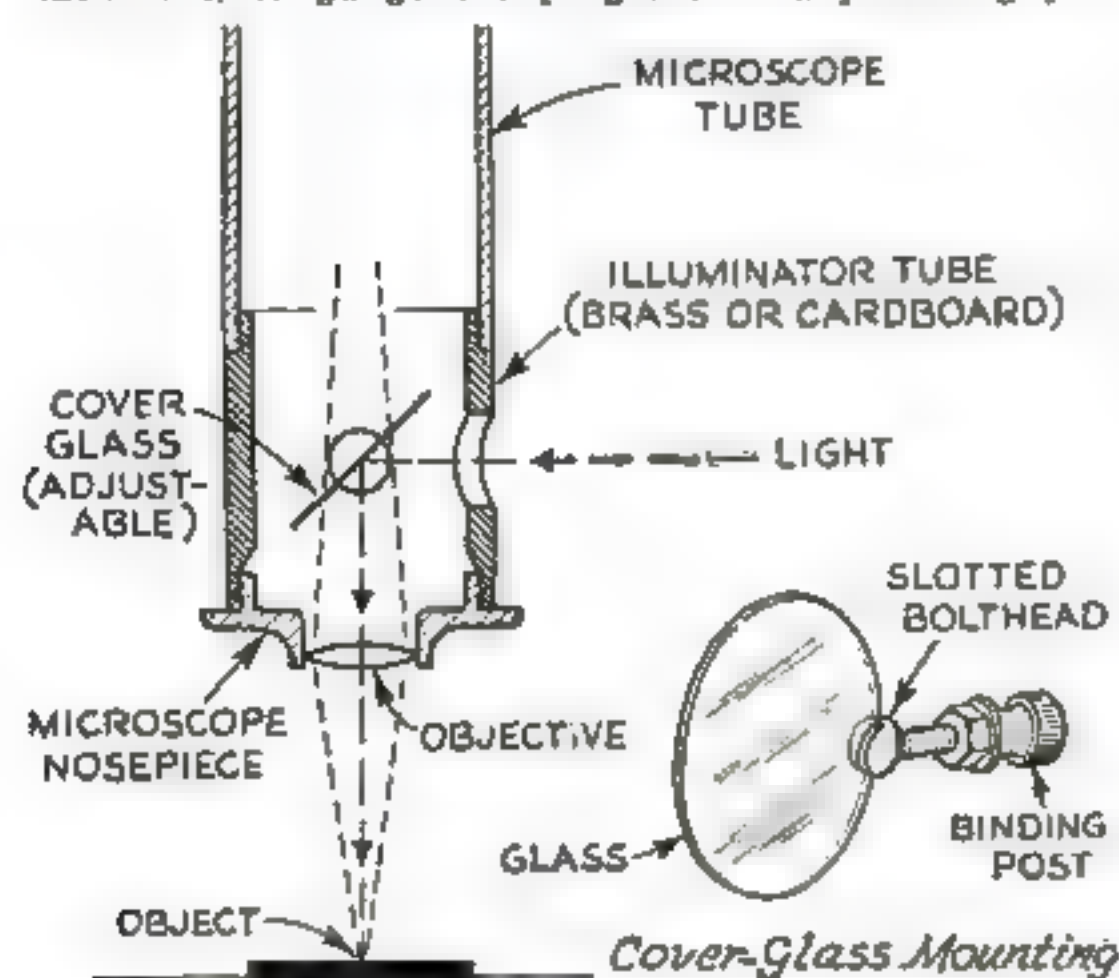


Using a small microscope in precision drilling. It is focused on a scale that moves with the drill bit



EXAMINING METAL WITH A MICROSCOPE

Surface markings on a brass button being inspected by means of a commercial vertical-illuminator attachment, to gauge the progress of a polishing job



HOW TO MAKE A VERTICAL ILLUMINATOR

If your microscope has an objective lens that can be unscrewed from the tube, you can rig up this vertical illuminator for examining various opaque objects

tered through walnut.

The arrangement of cells in a given specimen of wood produces a pattern that is characteristic of that wood. Thus, if you are familiar with the appearance of a piece of walnut under the microscope, you always can tell with certainty whether a sample of wood is walnut or not.

You can easily collect samples of various kinds of cabinet woods, including such well-known varieties as walnut, mahogany, and maple, as well as a great many of the rarer woods. From such samples you can make microscope slides which, when properly labeled and filed away, form a reliable reference "library" that can be used for identifying unknown woods at any time in the future.

The making of such a reference slide is a simple operation. Select a small block of seasoned wood that has not been stained, painted, or otherwise treated, and slice a number of very thin pieces from one end. A keen-edged razor blade can be used; and you can make satisfactory slices free-hand. Examine several of the tiny chips, and select the ones that show the grain structure most plainly. Try to include sections of three or four annual rings in each piece that you select for mounting.

As the wood already is dried, you can mount the slices immediately. To do this, drop a little Canada balsam in the middle of a clean glass slide, dip the wood specimen in xylol, and with tweezers lay it on top of the drop of balsam. Gently press the wood down into the balsam, until it is covered completely. The object is to immerse the wood without trapping air in its cells. Finally, lay the cover glass over the balsam, and set the slide aside to dry. Of course, if you desire, you can stain the wood with methylene blue or other dye, but most woods can be mounted without staining. Examine wood specimens by transmitted light, at magnifications of twenty to 100 diameters.

Frequently, the craftsman who is working with metal desires to know how well a polishing or grinding operation is being carried out. His unaided eyes may tell him; and again they may leave much room for doubt. But with a small microscope, he need never be uncertain. At fifty to 100 diameters, the surface marks on a piece of metal stand out like furrows in a plowed field. What appears to the unaided eye as a brilliant polish will be seen as a collection of irregular grooves and ridges. By comparing the depth and size of these markings, the degree of polish can be determined. In a similar way, bearing surfaces can be inspected, and bits of embedded metal or pits caused by corrosion can be seen. Metal objects can be examined for indications of rusting or other corrosion, and a hundred and one other useful observations can be made.

Since metal is opaque to light rays, it must be illuminated from above. Professional microscopes are equipped with vertical illuminators which send light rays down through the objective lens, to be reflected through the same lens by the metal surface. Although you can construct an effective vertical illuminator by mounting a cover glass or bit of mirror between the objective (Continued on page 121)

• Latest Conveniences

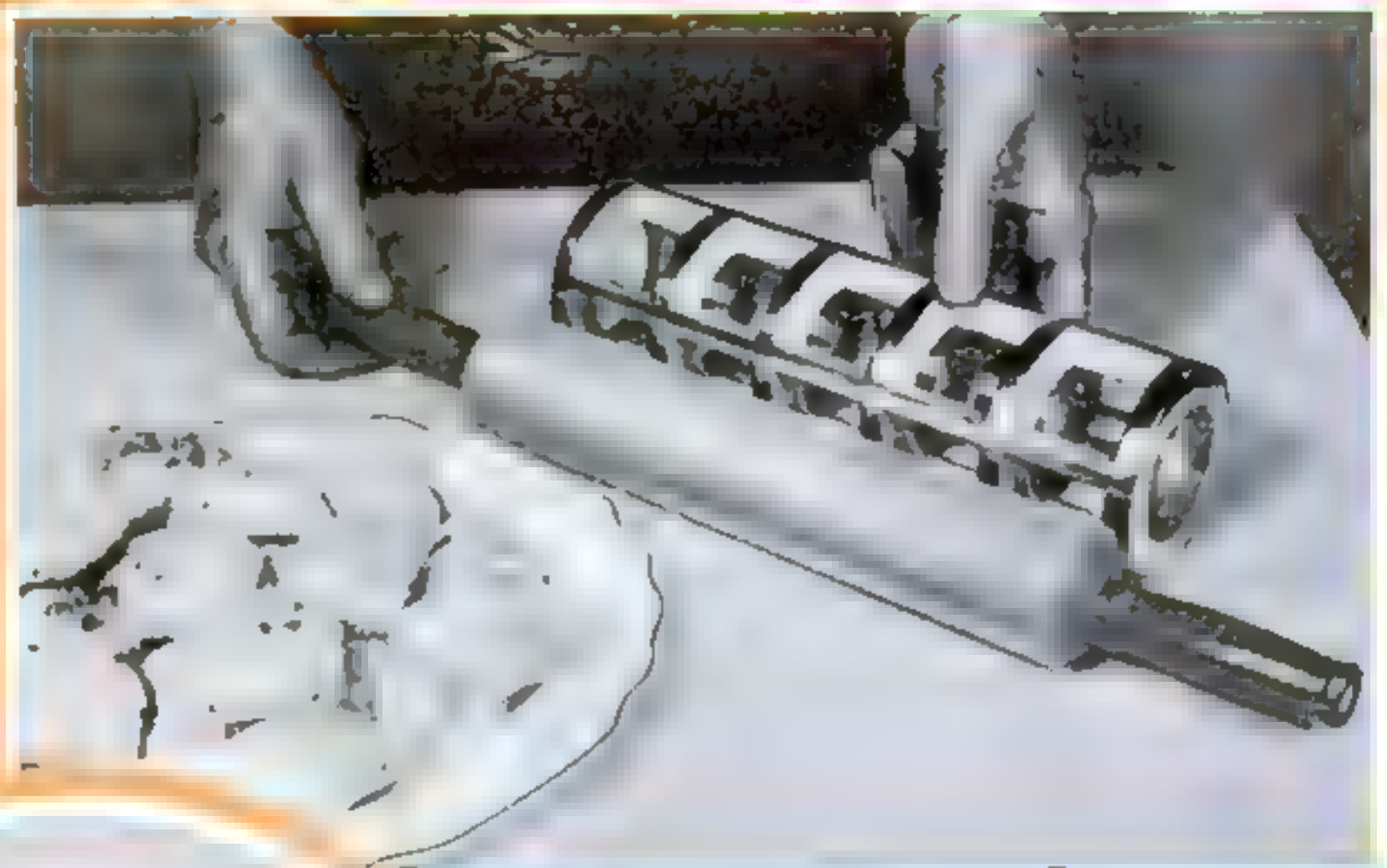


DOOR KNOCKER GUARDS MILK. Milk delivered to the doors of apartments or homes is safe from thieves and the neighbor's cat if the bottle is clamped in this double-duty door knocker. Once placed in the device, a bottle cannot be removed until the door opens.



TAPE IS STICKY ON BOTH SIDES

Putting on shelf edging is only one of the many uses the housewife can find for a new fabric tape that is coated with adhesive on both sides. In the roll, one side of the tape is covered with a linen backing that pulls off easily. The adhesive is said to hold firmly on glass, metal, or wood, and to leave no marks on the surface when removed.



CUTS FILLED COOKIES. A die made to fit on the rolling pin seals dough over filled cookies. Rolled over the two sheets of dough, with filling between, it stamps out the cookies.

FITS ALL FAUCETS. Rubber tubing can be attached to faucets of any size with the connector pictured at the right. The tapering elastic nozzle slips over large outlets, and is folded back to fit smaller ones.



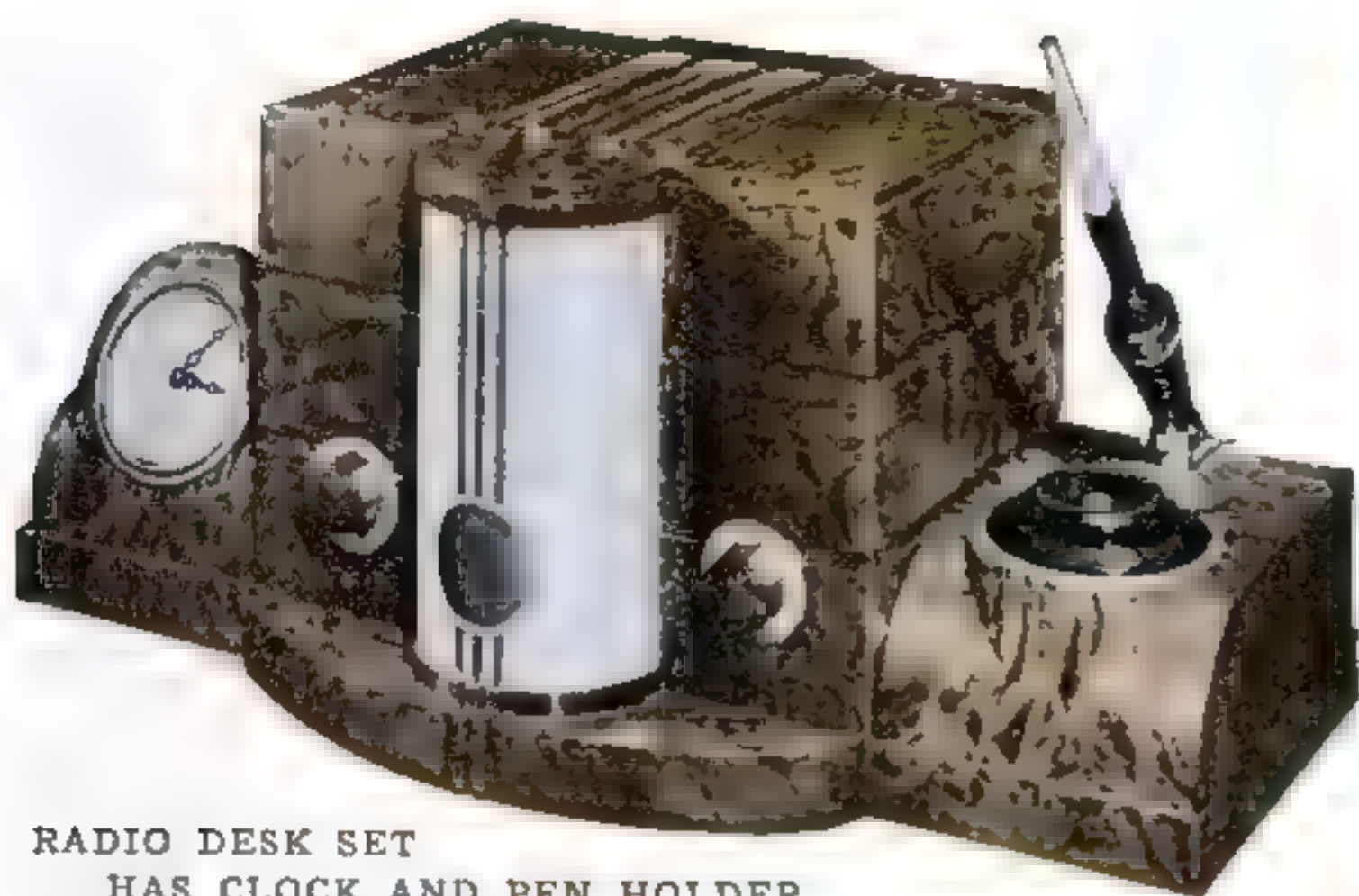
SEALS PIES. For sealing the edges of juicy pies so that they will not run over in the oven, a manufacturer supplies a specially prepared tape that is applied wet and strips off easily after baking.



ROPE CLAMP HAS SURE GRIP. Clotheslines, awning ropes, and similar fixtures are easily kept taut by the use of the rope clamp shown below. A pull on the rope tightens the line, and a pull on the handle loosens it. There are no teeth on the gripping surface to harm rope.



for the HOUSEHOLD .



RADIO DESK SET

HAS CLOCK AND PEN HOLDER

Any man—or woman, either, for that matter—would be delighted with this handy set which includes a radio receiver, electric clock, self-closing ink stand, and fountain-pen holder. Housed in a sturdy, mahogany-hued case of molded plastic material, it may be used in home or office



TUB SCRUBBER IS MADE OF SPONGE RUBBER

Cleaning bathtubs and other porcelain surfaces is made easy by a scrubber that has a pad of live sponge rubber mounted on a hard-rubber socket. In use, it may be either held in the hand or attached to a twenty-four-inch flexible spring handle



AIR-CONDITIONED REFRIGERATOR. Separate coils for freezing and food compartments in a new electric refrigerator make it possible to maintain subzero temperatures in the former while food is kept moderately cold with balanced humidity

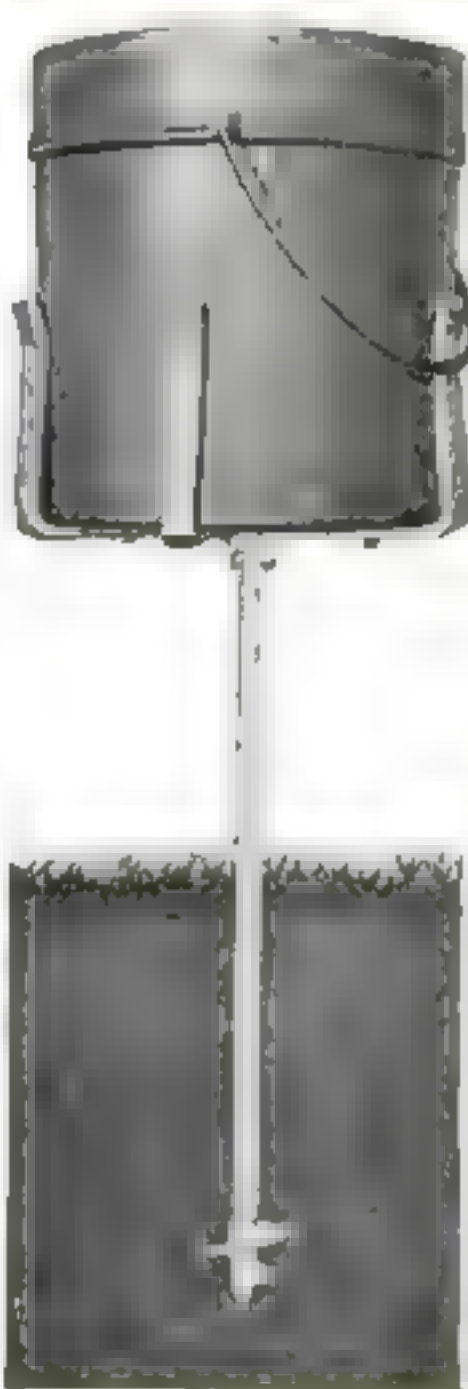


BATHROOM SHELF CONTAINS LIGHT

Installed above a washstand, this novel fixture not only holds toilet articles, but also casts light upward and downward, illuminating both washstand and mirror. Another suggested use is as a shelf for cosmetics above a make-up table, where it would light the face

GARBAGE CAN IS KEPT OFF GROUND

When screwed into the ground by means of its "auger" tip, the holder shown below supports a garbage can above the ground, out of reach of moisture and dogs



KITCHEN PAPER CABINET. Eight different kinds of paper for use in the kitchen are conveniently kept in the compact wall cabinet shown at the left. The plywood cover is designed to serve as a pastry board, and the outfit includes a handy chart for listing supplies needed and for other memoranda

Spectacular Tests with Rubber Balls and Wax Show How the



The rubber balls are prepared by rotating them in melted wax to obtain a thin coating

By
**GAYLORD
JOHNSON**



WHEN we speak of the glacial period, or ice age, we are apt to think of it as over and done with for good—as unlikely to return on earth as the prehistoric dinosaur.

When we see scratched and grooved rocks showing the terrific grinding power of the mile-thick ice sheet that once covered the northern part of our temperate zone, we never think of what might happen to New York, Chicago, Boston, Leningrad, London, and all our other northern cities, if the conditions should return which produced the age of ice in the Northern Hemisphere.

And yet, a very small change in the conditions which determine our climates and seasons could cause a return of the glacial period—and bring the destructive ice fields back into our temperate zone!

It is both easy and interesting to show with a simple experiment how this could happen. To perform it, only the simplest materials are needed. But first let us recall to mind a few facts that will be helpful in understanding the experiment.

First of all, the principal cause of the change from summer to winter, astronomers tell us, is the slant of the earth's axis to the plane in which the planets revolve around the sun. A glance at a diagram showing how the axis slants toward the sun in summer, and away from it in winter, makes it plain that the areas inside the arctic and antarctic circles are alternately deprived entirely of the sun's heat and light for months at a time.

This accounts for the polar ice caps of our world, and also those of Mars, our nearest neighbor in space, whose axis slants at almost the same angle as ours. Winter at one pole coincides with sum-

mer at the other, because the opposite poles are simultaneously exposed to, and sheltered from, the heating rays of the sun.

It is also easy to see that this prolonged cutting off of solar heat causes such an accumulation of ice that not even an entire summer's exposure to solar rays will remove it. Accordingly, inside the arctic circle, the ice cap is more or less permanent the year round—but, owing to the daily sunshine upon the entire surface outside the arctic zones, the permanent ice cap never extends much beyond this limiting circle.

With this condition borne in mind, let us now set up a simple experiment with two rubber balls of identical size, a couple of steel knitting needles, and a strong electric-light bulb. Our object will be to find out what would happen if we could vary the slant of the earth's axis, so that a larger portion of the globe was sheltered from the sun's rays during the winter. For convenience in carrying out our experiment, we shall consider only the Northern Hemisphere. The ball, of course, represents the earth; the strong electric bulb the sun.

We begin our preparations by making holes in the two balls and forcing the knitting needles through them, as near the centers as possible. This done, we melt a couple of cakes of paraffin wax and coat the two balls evenly by rotating them in the liquid wax and allowing the coating to harden.

When each of the balls has an even coating of wax, extending from pole to pole, and about a sixteenth

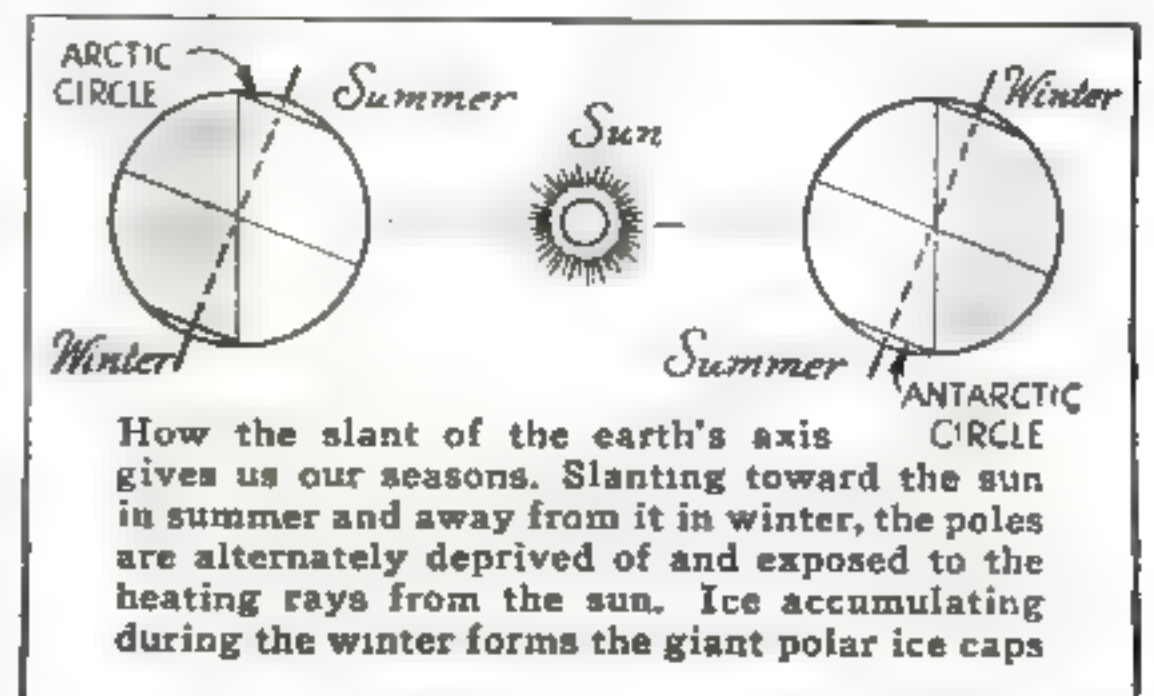
HOW POLAR ICE CAPS WERE FORMED

Unmelted by the heat from the lamp, the wax on the ball above shows the earth's present ice cap. Should the earth's axis shift from its angle of twenty-three and a half degrees to one of thirty-five degrees, the ice cap would grow larger, as shown by the model at the right

of an inch thick, we are ready to test the effect of varying the slant of the earth-ball's axis, while it is rotated in the rays of the hot lamp-sun. It is well to use a powerful bulb. I used one rated at 400 watts.

We can be sure that, whatever the slant, the wax will melt and drip off the ball wherever it is exposed to the hot rays of the electric bulb during rotation. We can also confidently expect that where the wax is not exposed to the lamp's heat during any part of its rotation, there the coating will be left unmelted, just as the ice in the polar regions is left solidly frozen by several months of shelter from the sun's rays.

In trying this experiment, I bored two holes in a board, at varying slants, to act as "bearings" in which the knitting-needle axes might turn easily, and to keep the



ICE AGE May Return



IF THE ICE AGE RETURNS. Should a change in the slant of the earth's axis cause a return of the ice age, civilization would be concentrated near the equator. Many of our important cities would be completely covered by the advancing wall of ice

angle, you recall, is the same as that formed by the earth's axis and the normal to the plane of its revolution around the sun.

As the wax-covered sphere turns slowly in the heat of the lamp, you will find the wax first softening, then melting, and finally dripping off upon the board below. Eventually, in a half-hour or so, depending upon the size and heat of the bulb used, all the wax, with the ex-

ception of the shallow cap within the "arctic circle," which never enters the lamp's melting light, will be removed.

When all but the "polar" wax has melted from one ball (rotated at the twenty-three and one half-degree angle,) let us take the other ball and rotate it before the lamp at a slant of thirty-five degrees. In a proportionate time, a slow rotation of the ball will melt off all the wax except that in the "polar" area, which is continuously sheltered from the lamp's heat.

Compare this area of unmelted wax with the polar wax cap left on the ball which was turned at an angle of twenty-three and one-half degrees—and what do you notice? A single glance shows that the wax area on the ball turned at the

thirty-five-degree angle is much larger. If we indicate on both spheres the outline of the American continents, it is apparent that if the earth's axis actually did slant at an angle of thirty-five degrees, the polar ice might be expected to cover about half of the United States!

If you now glance at the illustration showing how far south the ice of the glacial period is known to have extended, it is very natural to ask whether the ice age may not indeed have been caused by a change in the slant of the earth's axis. This supposition is, in fact, the basis of one of the many theories which have been proposed to account for the glacial period. It is called "Drayson's theory," after Maj. Gen. A. W. Drayson, the English scientist who first suggested the idea.

Drayson's theory advances some excellent mathematical reasons for believing that the slant of the earth's axis is not kept at a constant slant of twenty-three and one-half degrees away from the normal to the plane of its orbit, but gradually increases its inclination until it reaches an angle of thirty-five degrees. The effect of this increased slant upon the earth's climate would then be the same as the effect we produced upon our wax-covered ball by increasing its tilt away from the heat rays of the electric bulb. Just as the size of the polar cap of paraffin grew larger when the ball's axis was inclined at thirty-five degrees, so the earth's cap of ice would grow larger when its axis tipped to the same extent,—and the great glaciers would push farther and farther south. (Continued on page 109)

wax-covered globes turning before the hot lamp at the same unvarying angles. One hole was bored into the surface of the board at an angle of twenty-three and a half degrees to the vertical; the other at an angle of thirty-five degrees to the vertical. The correct angles were obtained by using a protractor to guide the drill.

To prevent any scattering of the lamp's rays, I also cut a round hole in a cardboard box, set up as shown. This allowed only a concentrated beam of light to reach the wax-covered ball.

With the apparatus complete as described, let us try the effect of rotating the ball in the hot rays of the lamp, with the knitting-needle axis turning in the hole which was drilled at an angle of twenty-three and one half degrees. This

**EARTH'S
ICE CAP IN
2000 A.D.**

EXPERIMENTS IN THE HOME LABORATORY WITH

Chlorine



Hydrochloric acid supplies you with material for making many useful chemicals and provides a series of fascinating tests of their properties

By
RAYMOND B. WAILES

OF ALL the chemicals on the home experimenter's laboratory shelf, few offer a greater variety of interesting and practical experiments than hydrochloric acid. Composed of two extremely active elements—hydrogen and chlorine—it combines readily with a large number of substances, making it possible for the amateur to manufacture many useful chemicals.

Used extensively in the metal-working trades, hydrochloric acid—or muriatic acid, as it is called when not in the pure state—is an easy chemical to obtain. However, the experimenter can make his own, if he desires, simply by heating a mixture of common table salt (sodium chloride) and sodium bisulphate in water.

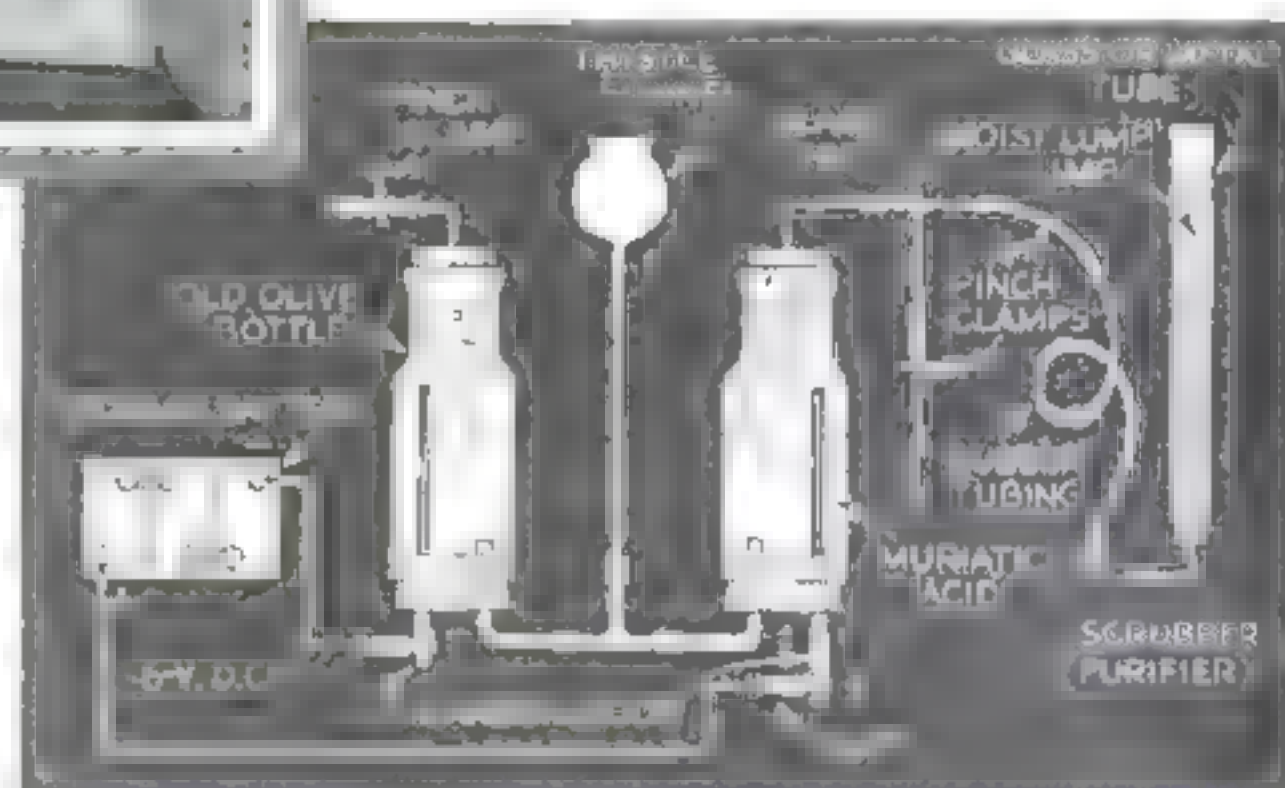
The apparatus consists of a retort or distilling flask connected to a series of four bottles—an empty or catch bottle, two bottles of water immersed in ice, and a conventional scrubber bottle containing moist lime or lumps of ordinary lye to absorb the excess hydrochloric acid gas and prevent it from contaminating the air. After being generated in the retort, the hydrogen chloride gas enters the catch bottle and finally bubbles through the two water flasks, where it dissolves in the water to form hydrochloric acid.

Being immersed in ice, the two water bottles carry off the heat formed by the combination of the hydrochloric acid gas and the water and make it possible for a much stronger acid to be manufactured. The empty or catch bottle serves as a trap to prevent the hydrochloric acid from being sucked back into the retort should the generation of the gas suddenly stop.

When the experiment is completed, the two water bottles can be removed from the set-up, provided with labels marked "Hydrochloric Acid," and placed with the stock of chemicals above your laboratory

HOW TO BREAK DOWN HYDROCHLORIC ACID

When an electric current is passed through hydrochloric acid in the apparatus shown above, hydrogen gas forms in one bottle and chlorine gas in the other. The drawing at the right illustrates the very simple set-up



bench. It is best to keep the acid in glass- or rubber-stoppered bottles.

If you open a bottle of hydrochloric acid and hold it to the light you will notice that it gives off fumes. This is caused by the hydrogen chloride gas escaping from the water and combining with the water vapor in the air to form tiny droplets of hydrochloric acid.

After making hydrochloric acid, you can proceed to break it down to show that it is made up of chlorine and hydrogen. This is accomplished by passing an electric current through it.

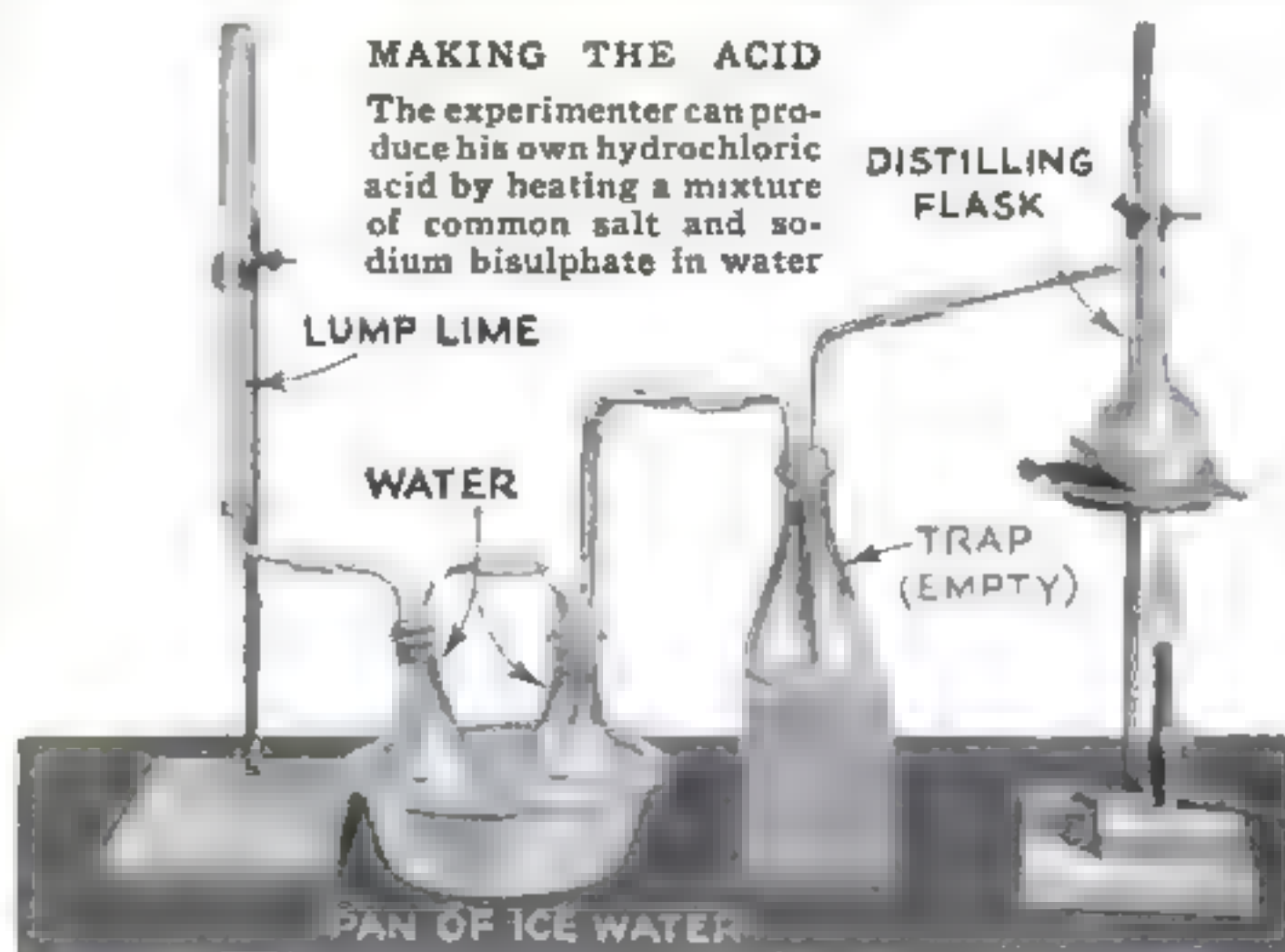
Known as electrolysis, the process is carried out by means of a simple piece of olive-bottle apparatus similar to that used in the diffusion experiments several months ago (P. S. M., Dec. '35, p. 52). It is modified slightly by fitting the two inner glass chambers with carbon rods salvaged from old flash-light cells. The chambers can be two olive bottles with their bottoms removed, two glass lamp chimneys, or two sections of large-diameter glass tubing. The open tops of the chambers should be fitted with corks carrying L-shaped pieces of glass tubing.

Since chlorine gas is extremely poisonous and

must not be breathed, a scrubber bottle also must be added to the system. This can be simply a tube or bottle filled with moistened lump lime. If, as the experiment progresses, it is found that one scrubber is not sufficient to absorb all the chlorine, a second should be added.

When the apparatus is set up, fill it to within an inch of the top corks with hydrochloric or muriatic acid, pouring the liquid carefully through the thistle funnel, and connect the carbon electrodes to a set of three or four series-connected dry cells, a storage battery, or any other six-volt direct-current source.

After the current is turned on, watch the electrodes. Almost immediately, small

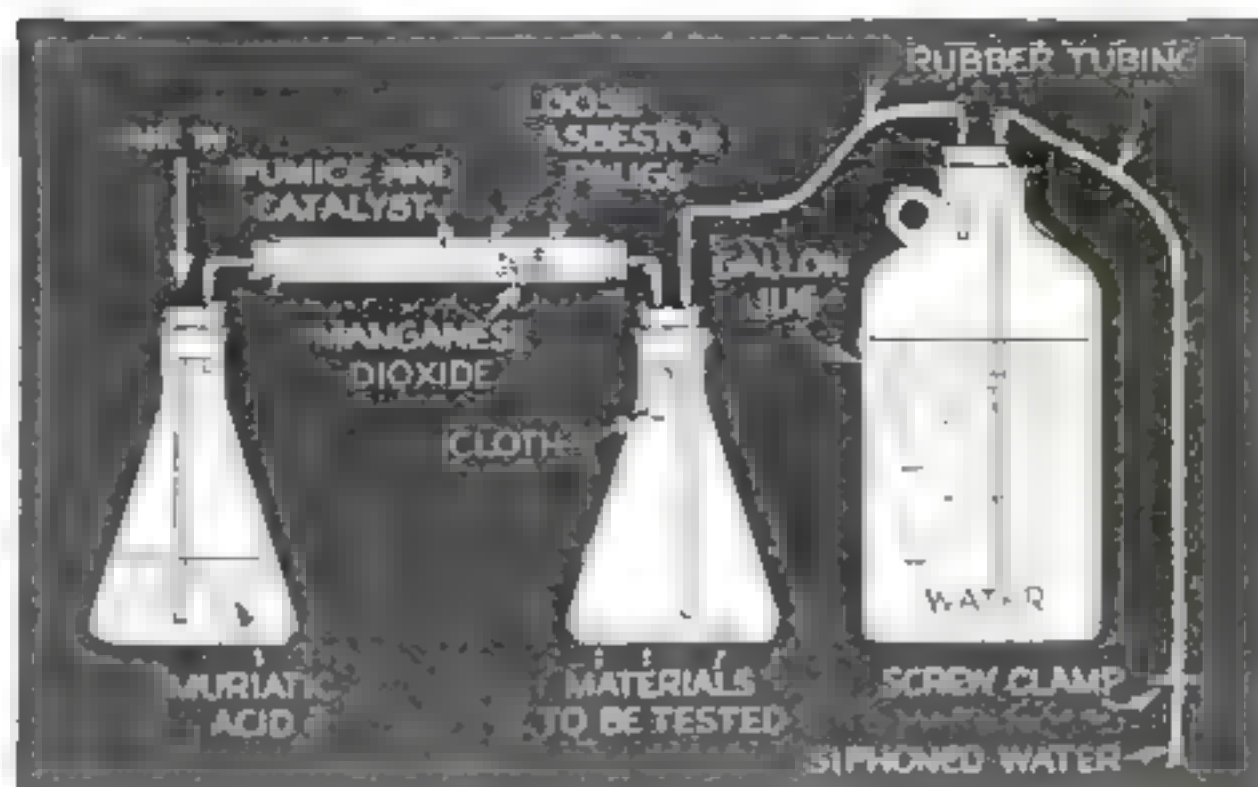


and Its Compounds

bubbles of gas will form, hydrogen gas collecting at the carbon rod connected to the negative terminal of the battery and chlorine forming at the positive rod. At first, the hydrogen gas will mix with the air trapped above the acid, but this mixture can be drawn off by opening the pinch clamp momentarily. After allowing the current to pass for about twenty minutes, collect some of the hydrogen gas by placing an inverted test tube over the outlet and opening the pinch clamp. Brought near a flame, the hydrogen gas in the tube will explode with a harmless pop to prove its identity.

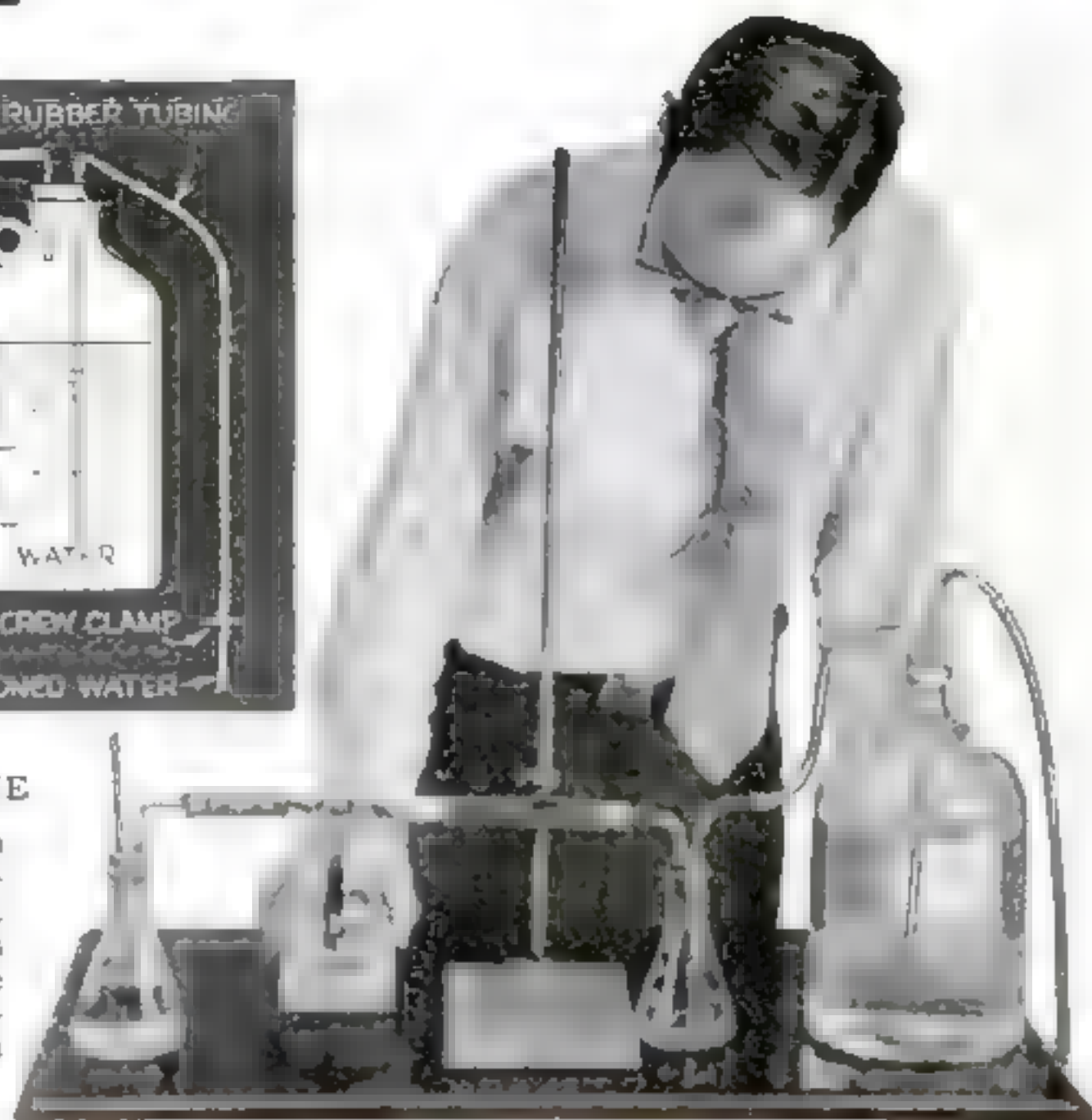
The chlorine gas generated at the positive electrode first will redissolve in the acid. After a few minutes, however, the acid will become saturated and the chlorine will flow into the scrubber where it will be converted into bleaching powder.

By closing the clamp leading to the scrubber and opening the clamp leading to the T-shaped tube, you can collect samples of the chlorine gas for experi-



"DEACON PROCESS" FOR CHLORINE

An old method for making chlorine from hydrochloric acid is duplicated by passing a mixture of air and hydrochloric acid vapor over a catalyst which aids the decomposition of the vapor by the oxygen in the air. The liberated chlorine bleaches the color from a damp cloth



mental purposes. Metals, you will find, will combine readily with the gas when heated, and damp colored cloth will be bleached.

When experimenting with the chlorine, place the substance in a test tube and insert the outlet from the chlorine chamber. Metals will react with the chlorine to form chlorides. Mercury placed in the tube and heated, for instance, will burn with a bright glow when the chlorine is admitted, forming crystals of mercuric chloride. Similarly, magnesium will combine with the chlorine to form magnesium chloride, antimony will react to

form antimony chloride, and iron will produce iron chloride.

In the early days of commercial chemistry, chlorine was manufactured from hydrochloric acid by what is known as the "Deacon process." The method is a simple one and can be easily duplicated in the home laboratory. In brief, it consists of passing a mixture of air and hydrochloric acid vapor over a catalyst, or "chemical accelerator," which is heated.

The mixture of hydrochloric acid vapor and oxygen can be obtained by rigging up a water siphon in such a way that, as the water empties out, it sucks air through a bottle of hydrochloric acid. In bubbling through the acid, the air (oxygen) picks up hydrogen chloride gas and the mixture passes through the catalyst tube to a collecting bottle.

In setting up the apparatus, the catalyst or reaction tube should be filled with small lumps of pumice stone or shredded asbestos which have been saturated with a solution of copper sulphate, or copper chloride, and dried. The mass should be packed into the tube loosely enough to allow free passage of the mixture of air and hydrogen chloride.

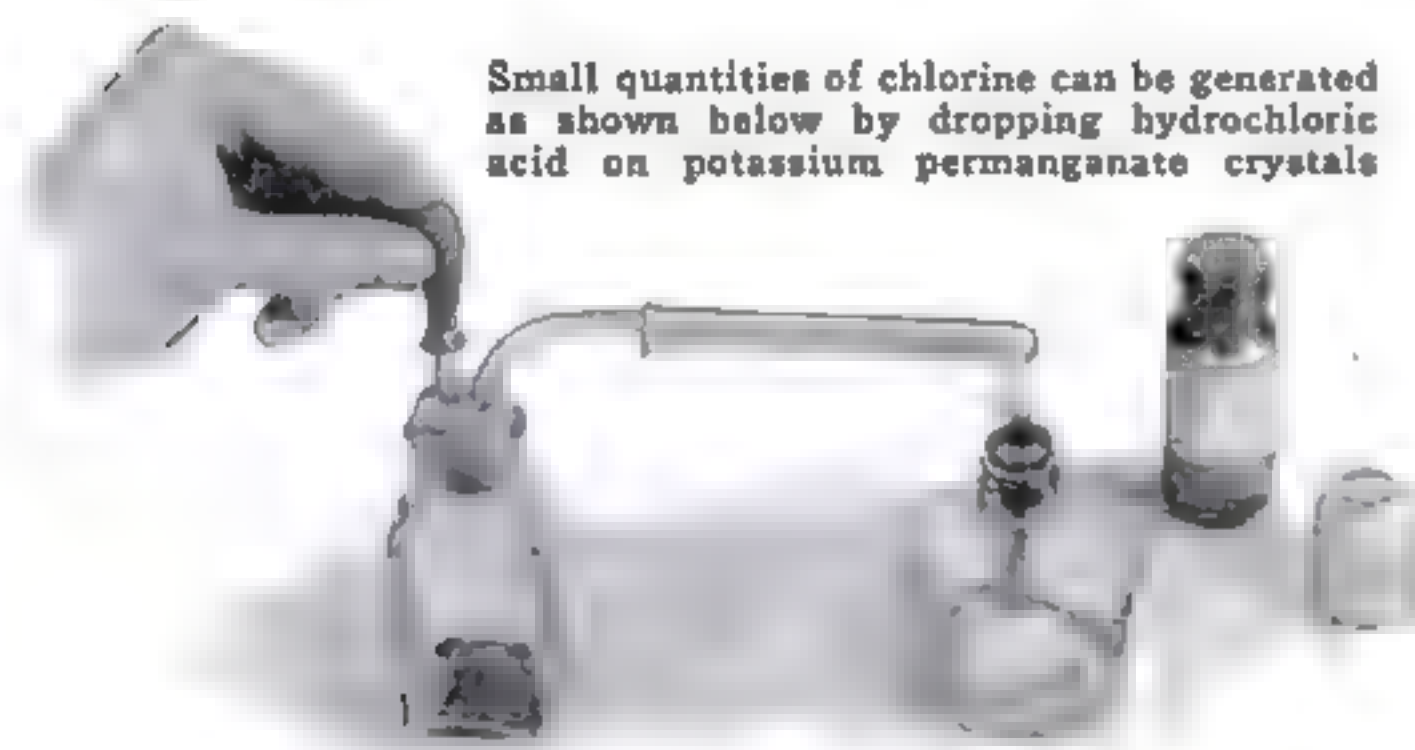
Acting as a catalyst, the copper sulphate or copper chloride simply aids the decomposition of the mixture and does not enter into the reaction. It remains unchanged throughout the experiment. Yet without it, no decomposition would take place.

To remove the hydrochloric acid vapors that pass through the apparatus unchanged, a small amount of manganese dioxide also should be placed in the reaction tube at the end connected to the collecting bottle.

That the hydrogen chloride gas is being decomposed to form chlorine can be shown by placing a piece of moist colored cloth in the collecting bottle. It will be bleached white.

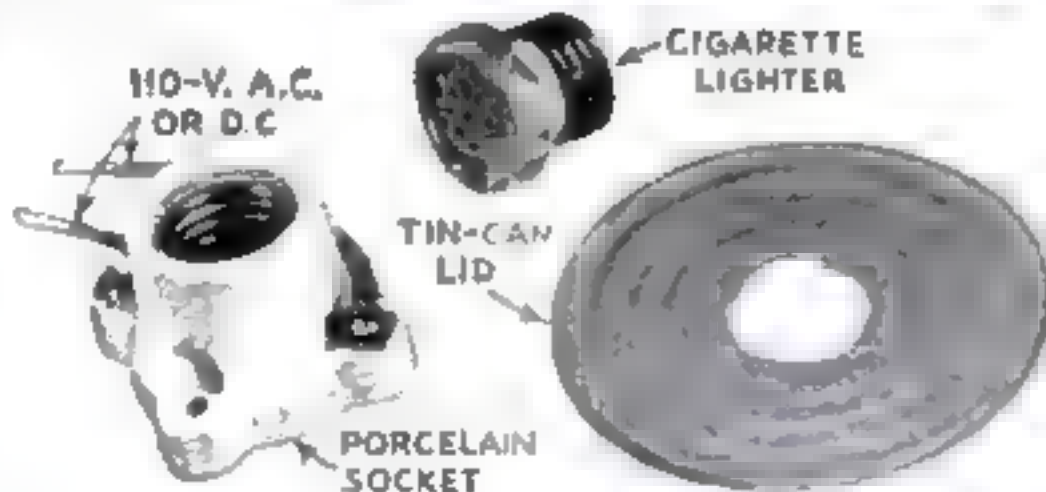
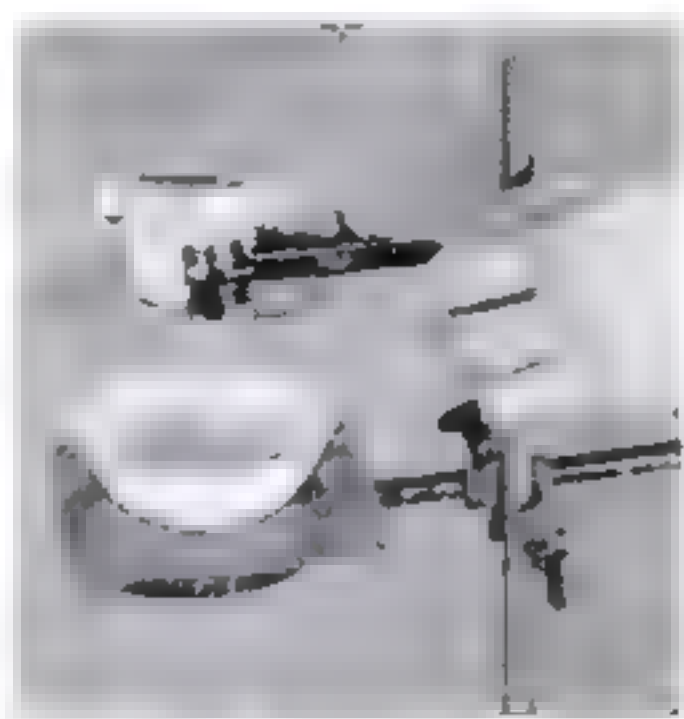
For general laboratory purposes, chlorine is easily *(Continued on page 128)*

Small quantities of chlorine can be generated as shown below by dropping hydrochloric acid on potassium permanganate crystals



Electric Cigarette Lighter Makes Handy Evaporator

IN RECOVERING the chlorides formed in the experiments described on these pages, and in many other operations that require solutions to be evaporated quickly, it is best to heat the liquid from above in order to avoid dangerous spattering. If your laboratory is equipped with electricity, you can easily make the handy overhead electric heater illustrated at the right. It consists of an electric cigarette-lighter element mounted in a porcelain socket and provided with a shiny metal reflector disk which is cut from the top of a tin can. In use, the heater is mounted over the evaporating dish, as shown, so that the warmth is reflected downward onto the surface of the liquid.



Scientific Stunts

FOR THE HOME EXPERIMENTER



Pouring Oil on Troubled Waters

BY ARRANGING an electric fan so that it blows evenly over two trays of water, causing waves, you can demonstrate why ships pour oil on rough seas. Drop the oil slowly into one of the pans, and the wave action will steadily decrease as the oil forms a strong blanket over the surface of the water.

Same Test Tube Contains Ice and Boiling Water

THE POOR heat conductivity of water is shown quite strikingly in this simple stunt which gives you steam and ice in the same container. Take a fairly large test tube and fill it one-third full with cracked ice. Drop in a ball of tin foil to hold the ice down, and fill the tube with cold water. By grasping the tube in the middle it can be held in your fingers without any discomfort while the top is placed in a flame and the water actually boiled. In spite of the water boiling above it, the ice will not melt in the bottom of the test tube as readily as might be expected.



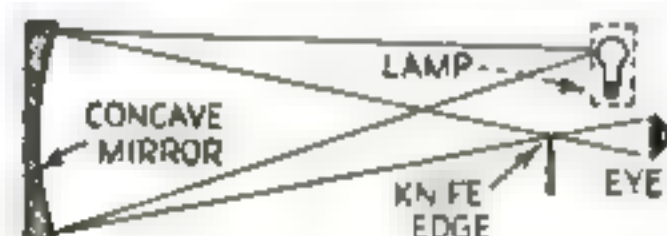
Frequency Affects Condenser Action

TO SHOW how high-frequency electric currents will pass through a condenser where those of low frequency will not, construct a simple condenser by gluing a square of tin foil to each side of a sheet of glass or cardboard. Connect the condenser in series with an ordinary sixty-cycle (low-frequency) alternating-current circuit, one wire to each tin-foil plate, and it will not pass enough current to light a lamp, but if wired in series with the radio aerial it will not interfere with reception.



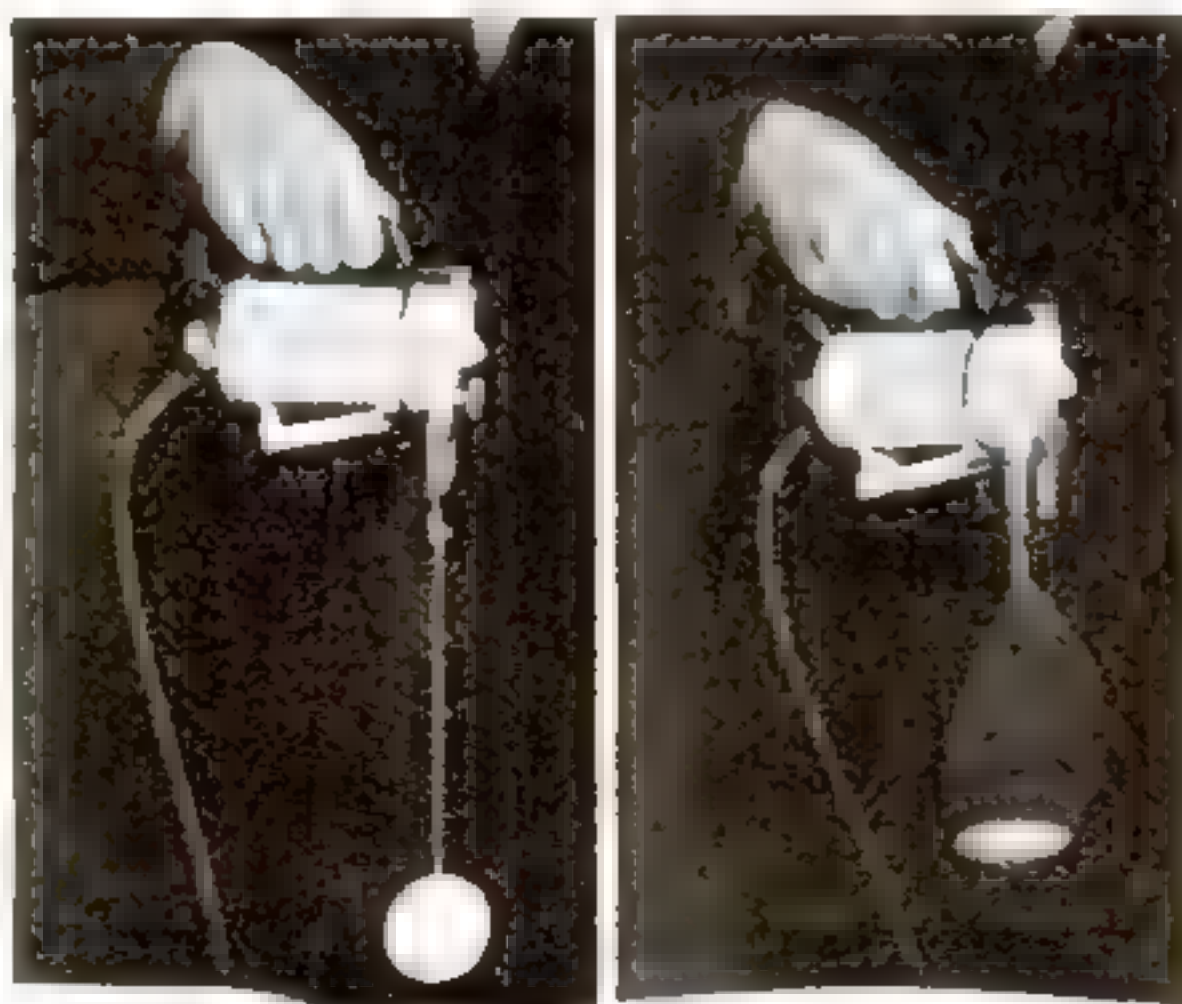
Shadows Reveal Flaws in Mirror

THE PRINCIPLE used in testing telescope reflectors can be shown with a concave mirror and an electric lamp covered with cardboard so that light escapes only through a pinhole. Place your eye so the whole mirror seems lighted, and move a knife across the light cone to bring out the shadows caused by faults.



Test Explains Cowboy Rope-Spinning Tricks

ROPE-SPINNING tricks and many other spinning phenomena depend upon the tendency of a rotating object to spin on its short axis. This tendency is easily demonstrated, as at the right, with an electric drill or a mixer motor. A cardboard disk, suspended by a string and rotated rapidly will seem to defy the law of gravity and turn up on its side. If the string is fastened to one end of a pencil, the pencil will rise and spin horizontally. A loop of chain also spins in a horizontal plane.



Surface Film Keeps Steel Afloat

WITH a tiny manikin made of wire, cardboard, and two safety razor blades, as shown above, you can demonstrate the strength of the surface tension of water. If you lower the steel blades carefully so as not to break the surface film, the little figure will float upright on the water.



Double lead-in strip of flexible copper being installed in a window

Useful Ideas *for* RADIO FANS

Doublet Lead-In Is Easy To Install

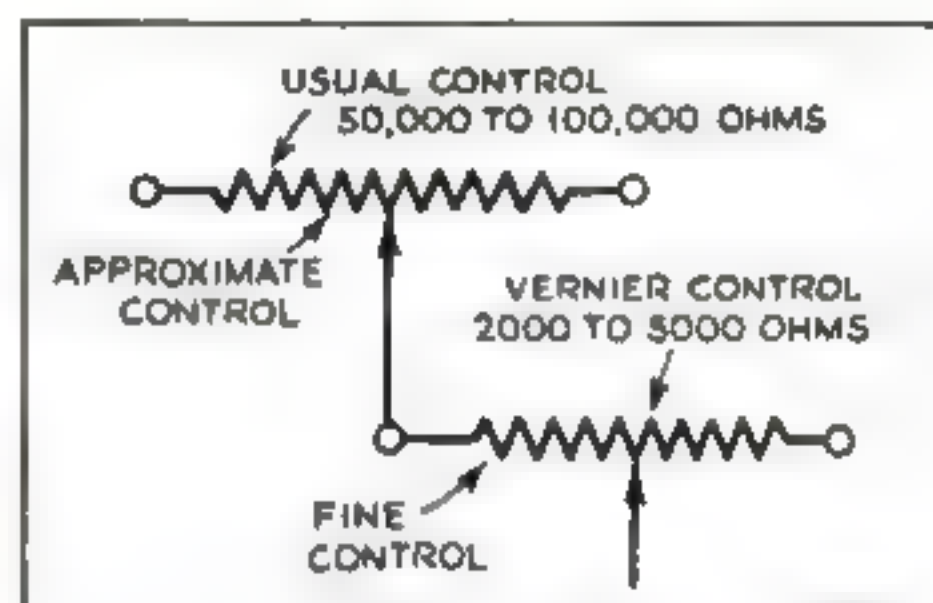
MADE like the familiar flexible "under-the-window-type" of antenna lead, a new double lead-in strip makes it an easy matter to bring the twin leads from a doublet-antenna transmission line into the house. Due to the rigid spacing provided by two insulating strips, a perfect match with the transmission line is obtained. Made of flexible copper with an outer covering of waterproof webbing, the double lead-in is provided with four screw terminals for easy installation.

Grid-Cap Shields for All-Metal Tubes

WITH a recently marketed auxiliary cap, it is a simple matter to provide adequate shielding for the grid-cap connectors on all-metal tubes. Pressed from sheet metal, the cap fits snugly over the recessed shoulder at the top of the tube. A slot cut into the side of the cap provides an entrance for the grid-connector wire. Tubes equipped with caps of this type give the set a neat and compact appearance, and they can be more easily kept free of dust around the connections.



This metal cap fits snugly over the tube's shoulder



Twin Controls Improve Regenerative Receivers

BY ADDING a second potentiometer, the regeneration control on most regenerative receivers can be greatly improved. The auxiliary control should have a resistance of about one twentieth the value of the original. Because the arm of the low-value control can be moved twenty times as far as the regular control for the same circuit change, it provides a smoother and finer adjustment of the regeneration for this type of receiving set.



Auto-radio lock in place over bulkhead mounting bolt

New Lock Safeguards Auto Receivers

WITH an ingenious lock now available, car owners can safeguard their auto radios against theft. Designed to fit over one of the receiver's bulkhead mounting bolts, the lock is installed simply by removing the original nut, substituting a special bushing and nut, and snapping the lock in place over the bolt end. Serving as a cap, the lock works the same as many spare-tire locks, making it impossible to remove the nut.

Plierlike Tester Has Many Radio Uses



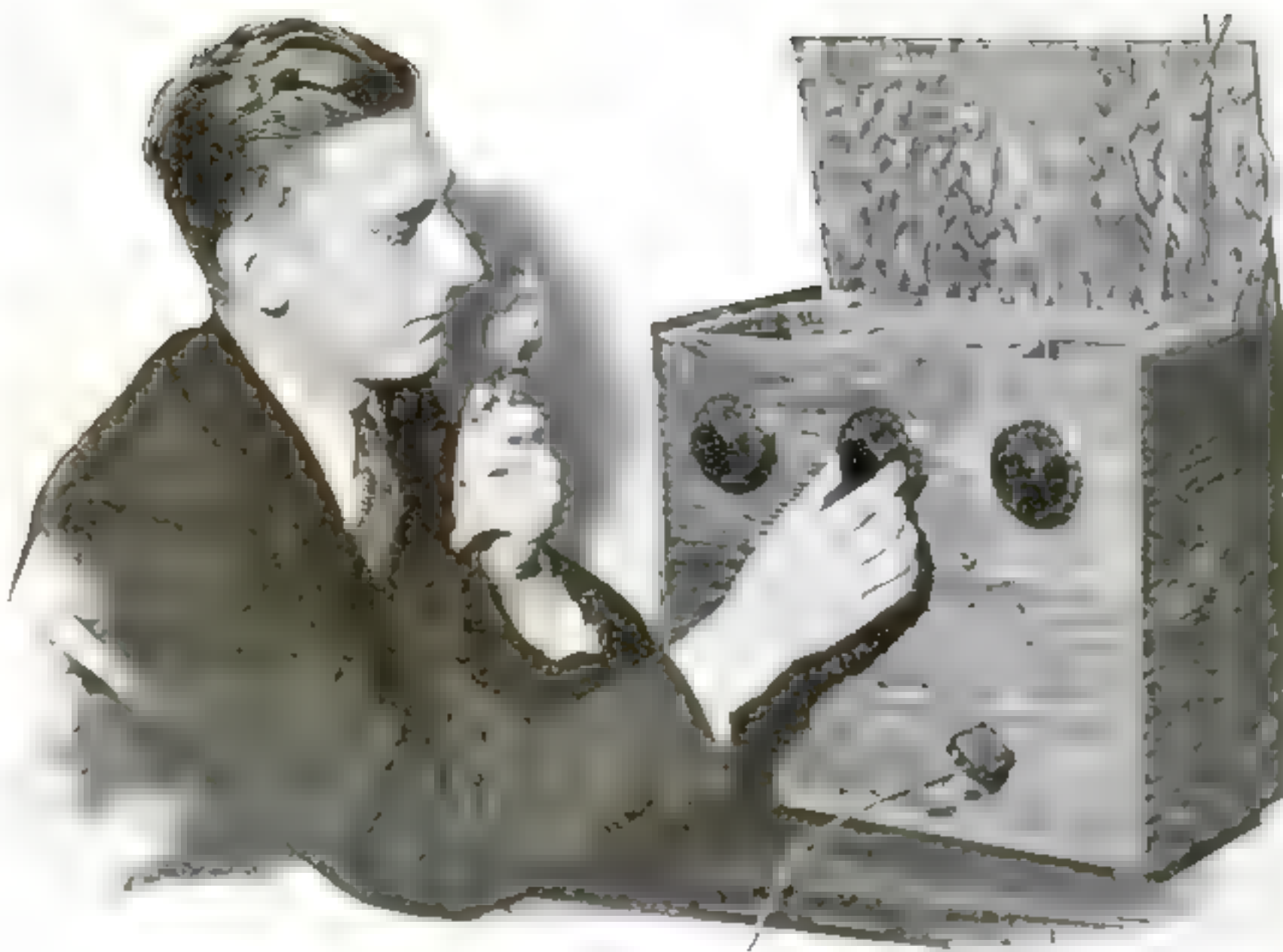
Novel combination tool being used as a tester and, at right, as pliers for handling a fuse

RESEMBLING a large pair of pliers, a new combination radio tool provides a neon tester for fuses, condensers, and circuit polarities, and a safe means for handling fuses and live wires. Terminals at the tips of the molded handles lead to a small built-in neon test light. In tests, the handle ends are simply bridged across the circuit.



Midget Fuses Provide Protection for Meters

DESIGNED to fit into cramped quarters, midget fuse holders now on the market can be mounted directly on the terminal post of any meter. Installed and provided with the proper fuses, they will protect your sensitive instruments from damage due to dangerous overloads. Miniature fuses for the holders are available in a variety of sizes ranging from one milli-ampere up to five amperes.



The portable transmitter in use. The radio-frequency unit is mounted on a separate chassis and can be used independently as a c.w. transmitter for code work

By JOHN CARR

DESIGNED to operate on a single six-volt storage battery, the short-wave transmitter illustrated is an ideal unit for the radio amateur who wants a powerful yet portable circuit. Covering the wave lengths from twenty to 160 meters on either code or phone, the compact outfit is capable of an undistorted output of more than twenty watts.

In most battery-operated transmitters, the low voltage available makes it impossible to obtain any great amount of output power. Through the use of a miniature motor-generator set, however, this circuit is provided with a 300-volt, 150 milli-ampere power supply. The lightweight power unit, operating on an ordinary six-volt storage battery and supplying direct current, eliminates the necessity of expensive "B" batteries and complicated filter networks.

To provide maximum flexibility, the transmitter is constructed in three separate parts. The top section contains the radio-frequency, crystal-controlled oscillator, the class "C" amplifier, and the antenna-coupling unit. The bottom section houses the modulator and the midget motor-generator power supply. Each section can be easily removed and, despite the compactness of the entire circuit, there is no troublesome crowding of either the parts or the wiring.

In the interest of simplicity, the circuit has been designed along strictly conventional lines. The oscillator, a type '42 tube, is capacitively coupled to the class "C" amplifier through a small mica compression-type condenser. This together with the 6A3 output tube is mounted as a unit on a single chassis.

For maximum transfer of power to the antenna, the output tank circuit is link-coupled to the antenna coil. One or two turns of wire wrapped around the amplifier tank and two or three turns around the antenna coil were found to provide good output to the antenna on all bands. A little experimenting with the link coupling, however, is advised, since tight coupling may cause poor modulation when the

circuit is used for phone.

To obtain maximum output from the radio-frequency portion of the transmitter, it is essential that all parts be of low-loss construction and that the tuning condensers be thoroughly insulated from the aluminum chassis. The sockets for the tubes and plug-in coils should be made of isolantite or similar material. It should be remembered, that, owing to the capacity effect of the dielectric, a good insulator for direct current is not necessarily a good insulator for radio frequencies.

Because it is mounted on a separate chassis, as an individual unit, this portion of the circuit can be used independently as a c.w. transmitter for code work, if desired. The modulator unit can be added later and the combined circuits then used as a combination code and phone transmitter.

The modulator, mounted on a separate chassis fitted into the lower shelf, uses two 6A6 tubes. There are no tricks to this circuit, since it is basically a straight audio amplifier.

To insure good quality, a heavy-duty output transformer is recommended. The unit used in the original is capable of carrying the full current of the class "C"

A Portable

BUILT TO

A Miniature Motor-Generator Set Provides a 300-Volt Power Supply For This Light, Versatile Outfit



Rear view of the outfit, showing the locations of the various units. Each portion of the circuit can be removed separately

stage without difficulty. If a smaller transformer is used, it will be necessary to keep the direct current for the modulated amplifier out of the secondary windings through the use of an extra audio choke and condenser. The choke should have an actual inductance of thirty or more henries with a current rating of 100 milliamperes. The condenser should have a capacity of about four microfarads and be rated at 600 volts.

Since the "gain" of the speech system is just about right for the average single-button microphone powered by a 4½-volt battery, no "gain control" is incorporated. The "gain," however, can be varied by the simple expedient of moving the microphone closer to, or farther away from, the speaker. A distance of about six inches will be found to be correct for most single-



Bottom views of the radio-frequency and modulator chassis. Note their independent construction

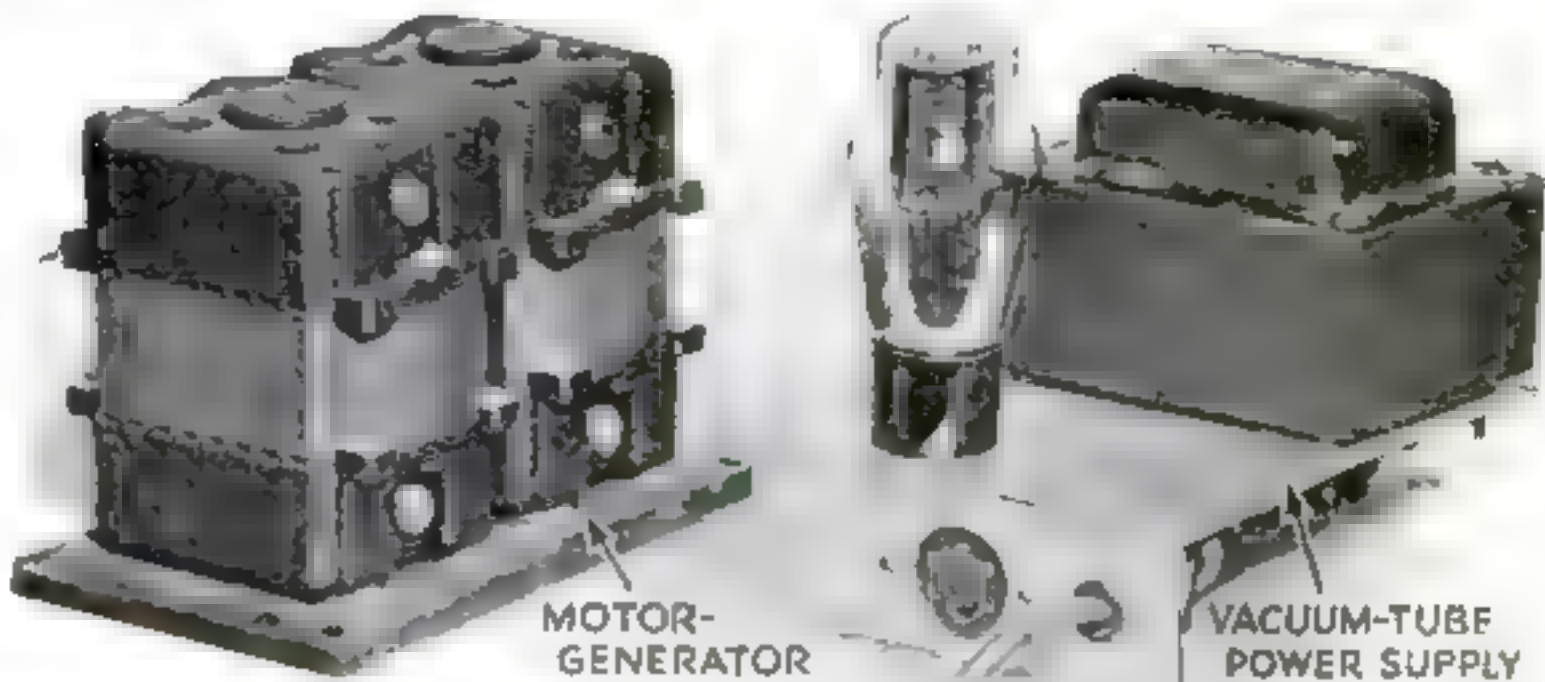
Short-Wave Transmitter

OPERATE ON SIX-VOLT BATTERY

COIL-WINDING DATA

Coil	1750 KC.	3500 KC.	7000 KC.	14,000 KC.
	50 turns	34 turns	19 turns	9 turns
L ¹	No. 22 E. 2" form	No. 22 E. 1½" form	No. 16 E. 1½" form	No. 14 E. 1½" form
	54 turns	38 turns	21 turns	11 turns
L ²	No. 18 E. 2" form	No. 18 E. 1½" form	No. 16 E. 1½" form	No. 14 E. 1½" form
	45 turns	28 turns	15 turns	7 turns
L ³	No. 18 E. 1½" form	No. 18 E. 1½" form	No. 16 E. 1½" form	No. 16 E. 1½" form

If the circuit will not tune to resonance, a few turns must be added or removed from the above coil data. However, the above data is correct for use with the tuning condensers specified in the list of parts.



The two power supplies that enable the set to operate on either house current or a small battery

button microphones under normal voice conditions.

Originally developed for airplane service, the lightweight motor-generator set used as the power supply is ideal for use in a portable transmitter. The motor, driven by a storage battery, is quick-starting and the generator builds up to its full voltage of 300 volts almost instantaneously. In wiring the power supply, it is important that heavy leads be used between the motor-generator and the storage battery as any drop in the input voltage will seriously affect the output. Two No. 8 insulated wires provided with terminal clips were used in the original.

For those who do not desire the motor-generator power supply, a standard vacuum-tube power circuit can be substituted. Such a circuit, mounted on a chassis, is shown in the photographs. An outside source of 110-volt alternating current is necessary if the tube circuit is used.

The antenna arrangement employed will depend to a large extent upon space limitations. For the 160-meter band, the regular Marconi antenna-ground system will prove to be quite efficient and the easiest of all types to set up. The length is not critical, as there is considerable latitude due to the size of the tuning condenser

used in the antenna circuit. For the other amateur bands, the ¼-wave Hertz is recommended.

The transmitter can be tuned in any of the conventional ways with either meters, a neon glow lamp, or a small radio dial bulb (P.S.M., June '35, p. 55). If the dial bulb is used, connect a two-inch loop of wire to the terminals of the lamp. No loop is needed when the neon lamp is used.

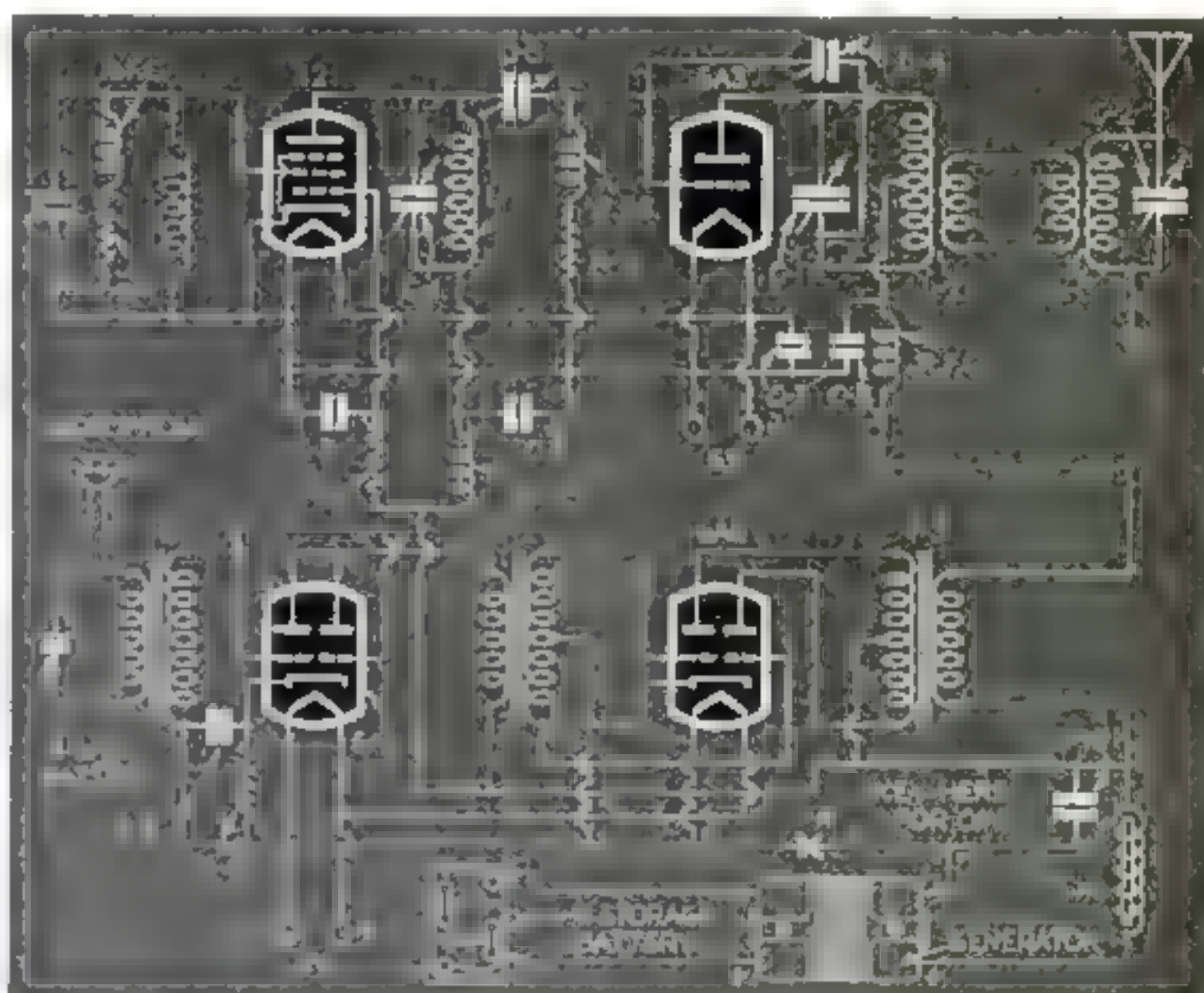
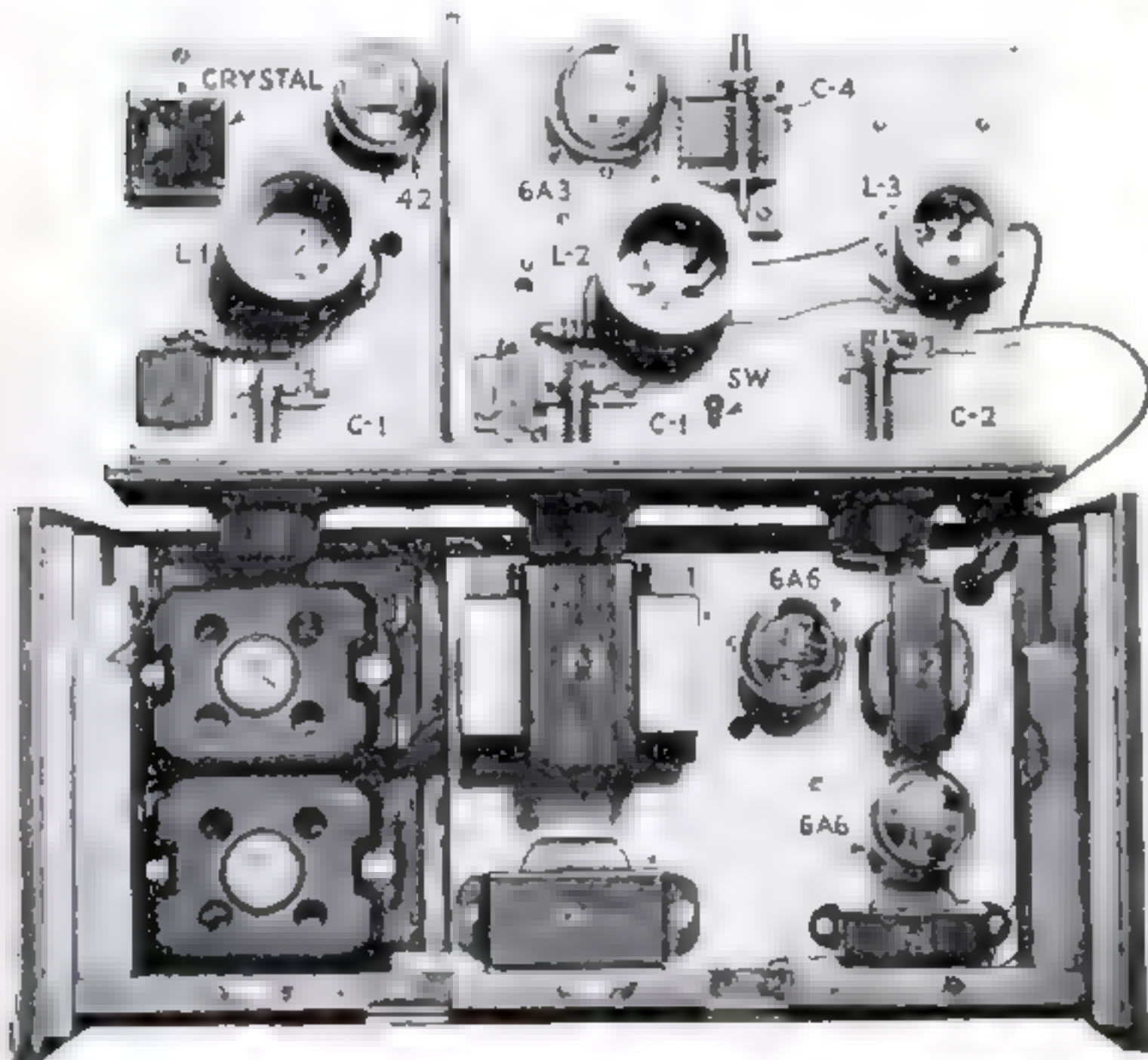
Although no meters are included in the transmitter, provision for measuring oscillator and class "C" amplifier plate current is made by means of closed-circuit jacks on the front panel. When neutralizing, the switch in the "B" plus lead of the 6A3 tube should be in the "off" position.

The distance-covering possibilities of the circuit will depend, to a large extent, on the radiation efficiency of the individual antenna system, the wave band used, the location of the station, and general atmospheric conditions.

As with all short-wave transmitters, this circuit should not, of course, be operated unless the owner is a licensed amateur. However, the lack of a license need not prevent you from building the circuit, and when your license is granted your station will be complete and ready to go.

LIST OF PARTS FOR THE SHORT-WAVE TRANSMITTER

- C₁—Variable condenser, 100 mfd.
- C₂—Variable condenser, 250 mfd.
- C₃—Variable condenser, 220 mfd.
- C₄—Variable condenser, 50 mfd.
- C₅ and C₆—Fixed condensers, mica, .01 mfd.
- C₇—Fixed condenser, paper, .05 mfd.
- C₈—Fixed condenser, mica, .001 mfd.
- C₉—Electrolytic condenser, 25 volt, 50 mfd.
- C₁₀—Electrolytic condenser, 450 volt, 16 mfd.
- R₁—Resistor, metallized, 25,000 ohm, 1 watt.
- R₂ and R₃—Resistors, metallized, 50,000 ohm, 2 watt
- R₄—Resistor, metallized, 1,000 ohm, 2 watt.
- T₁—Transformer, single-button microphone.
- T₂—Transformer, class "B" input.
- T₃—Transformer, modulation.
- Ch—Choke, 90 ohm, 150 ma.
- RFC—Radio-frequency choke, 2 mh.
- RFC₁—Radio-frequency choke, 8 mh.
- Miscellaneous.—Motor-generator set (300-volt, 150 ma.), tubes, sockets, coils, microphone, key, chassis, cabinet, jacks, switches, dials, control crystal, wire, etc.



As seen in the diagram, the circuit has been designed along conventional lines. Left, radio-frequency and modulator circuits as viewed from above



"Can you beat that!" the tourist gasped. "That's exactly what I have got. What are you—a mind reader or something?"

Keep Your Car Looking New

HOW MUCH farther it is to that tourist camp, Gus?" Joe Clark's voice broke into the monotonous droning of the motor and the steady whistling of the wind as it rushed past the fast-moving car.

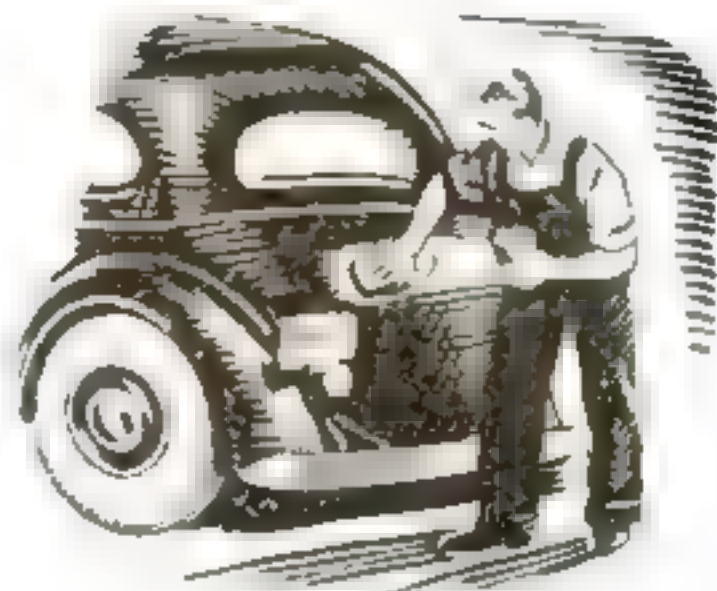
"Thinking about dinner, maybe?" Gus Wilson grinned, as he shifted one of his huge hands to a different grip on the steering wheel. "I could use a hamburger right now, myself! About ten minutes more at the speed we're making ought to land us there."

Joe gazed appreciatively at the colorful sunset toward which they were heading. "This is the life, Gus!" he exclaimed. "If you ever have to go to any more family reunions, I hope they come at a time like this when we can both leave the Model Garage for a few days. It's kind of nice not to have to think about automobile troubles all the time."

"Sure is—other people's troubles, anyhow," Gus chuckled.

Dinner out of the way and their baggage settled in a comfortable little cabin, the two automobile men drifted over to join the circle of tourists seated in folding chairs around the glowing campfire.

"It's just a waste of time and money bothering with that junk," one of the men in the group was holding forth to the others as Gus and Joe joined them. "All those cleaners and polishes do," he continued, "is to wear away the enamel—and then what have you got? Your car looks like a dog with the mange! I'm telling you, the best way to keep a car looking well enough to get a high trade-in value is



to have it washed once every two or three months—or not even that often if you haven't got it very muddy. Isn't that so?" he finished, turning to Gus for support.

"Lot's of drivers treat their cars that way," Gus grunted noncommittally, as he rammed a charge of tobacco into his pipe with a horny thumb, "and you're right about some of the auto-body polishes being a bit hard on the finish."

"Trouble with that scheme," broke in another man, "is that most of the time you're driving around in a filthy-looking car. What's the use of having a new car if you treat it that way? A fellow doesn't like to go around in a dirty shirt, so why should he go around in a dirty car?"

"That's not the same thing at all," protested the loud-mouthed chap indignantly, as a chuckle went around the circle.

"I can tell you a better scheme than that, by Jimminy!" piped up a wizened little fellow. "A man I know was sent by his firm to another city where his work made it necessary for him to have a car.

He knew he was only going to stay there about a year, and then he'd go back to the home office again. Sensible thing for him to do would have been to buy a good secondhand car, but he had a prejudice against secondhand things, so he bought a new one. Then, somebody threw a scare into him about how much he was going to lose when he came to sell, so he vowed he wasn't going to lose any more than he could help. He bought himself a can of real sticky cup grease and smeared a thin layer of it all over that car from stem to stern. Covered every bit of paint and metal work, he did."

The little fellow paused while he bit the end off a cigar and lighted it.

"Well, sir," he went on, "you should have seen that car after he'd driven it a few hundred miles over dusty roads. It looked like the whole car had been carved out of a lump of mud and left in the sun to dry. Worst looking thing you ever did see. When his year was up and they called him back, he spent two whole days getting that mess off with kerosene—but, by cracky, it looked like new and he sold it for a thumping big price, considering the miles he'd driven it in a territory that is death on car finish."

After the comment provoked by the little man's tale had subsided, another member of the group had something to offer. "What I can't understand," he grumbled, "is why the car manufacturers can't put the finish on evenly. There's always a fender or some other part of the car that gets to looking old and shabby long before the *(Continued on page 130)*

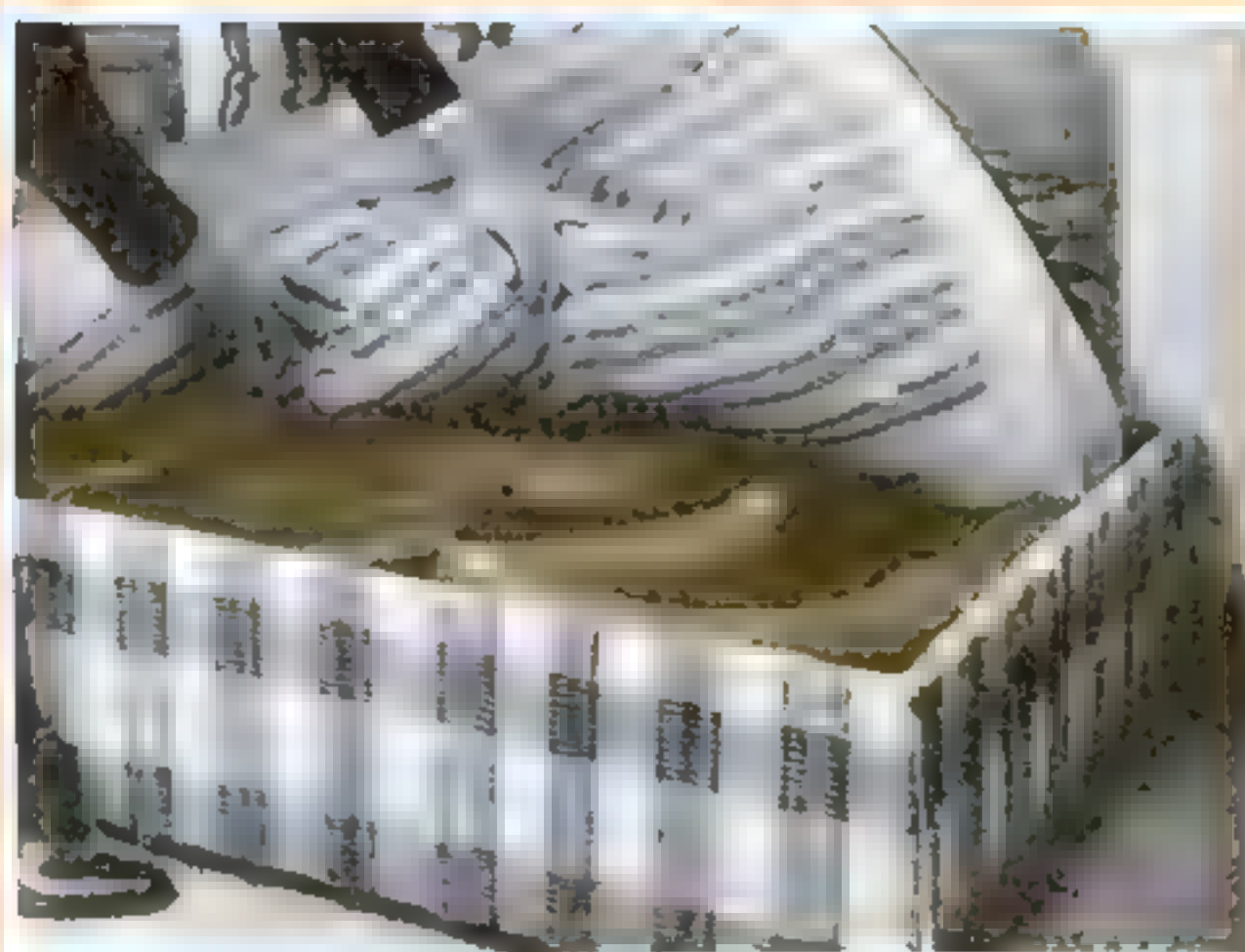
By MARTIN BUNN

THE HOME WORKSHOP

Studio Couch

Built at Low Cost
with Old Inner Tubes
in Place of Springs

By
K. F. KEITH



Five old inner tubes are sufficient to form the "springs" of the couch. They are tied in place with cords tacked to the bed

This couch was built complete for less than \$10, yet it compares favorably with commercial articles costing a great deal more

tion to give uniform support to the mattress. To prevent them from shifting, pass a loop of strong cord around them wherever necessary and tack the ends to the bed. Use four or five of these cord stays for each tube.

The sides and ends of the couch are covered with any suitable material. I used

heavy curtain cloth, pleating it as illustrated and fastening it with upholstering tacks along the upper inside edge.

You may even be able to devise a substitute for the mattress, but I had my mattress made to order. It is 3 by 6 ft. and 4 in. thick, and the local mattress maker in the Florida town where I live charged four dollars for it, covered with monk's cloth.

are set into the recesses so formed, thus providing the proper height from the floor. This detail should be watched during construction, as casters vary in dimensions. I found the most satisfactory type to be one in which the caster and the attaching plate are a single unit.

Along the inside of both walls are nailed or screwed

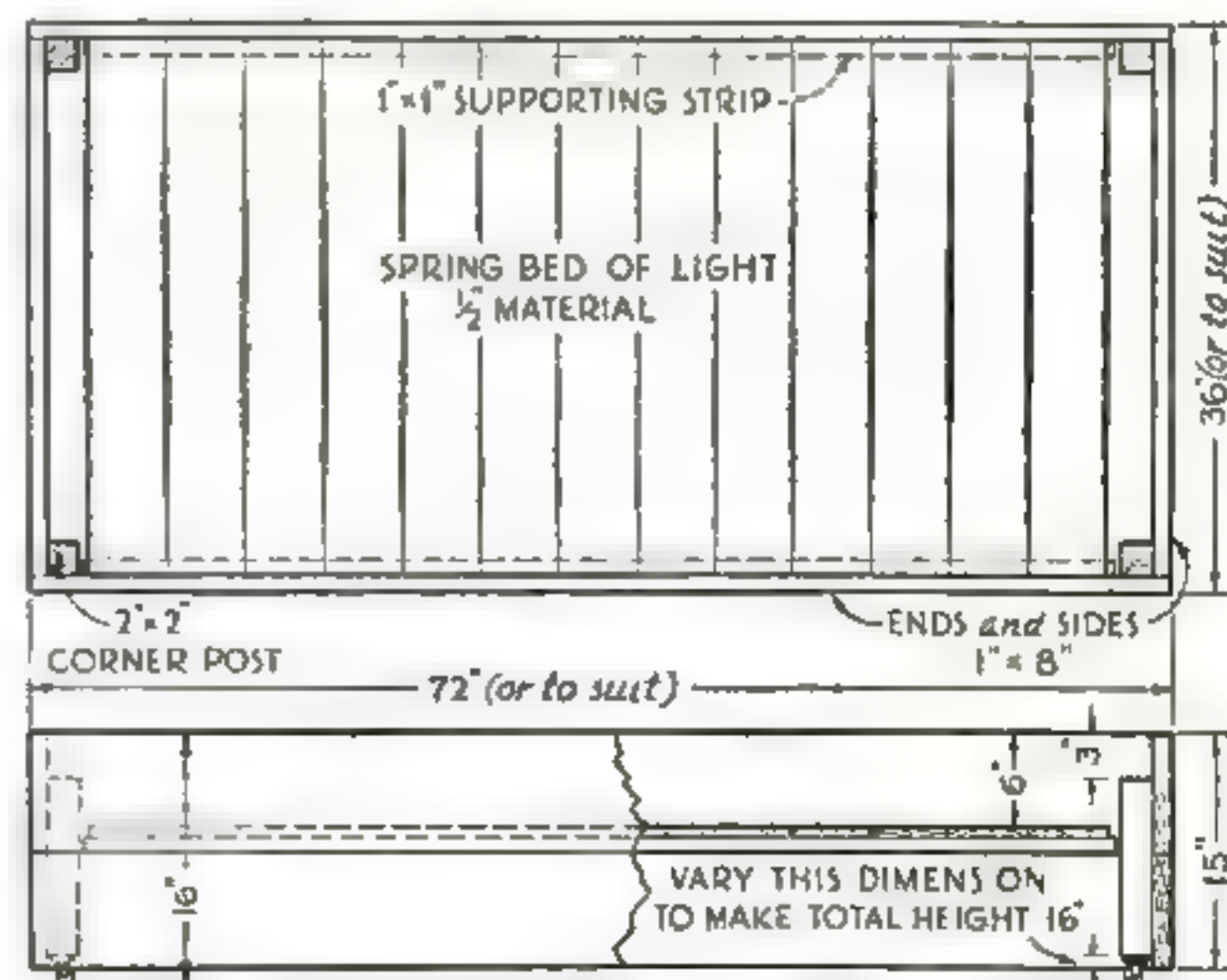
two 1 by 1-in. strips to support the bed. On these are laid crosswise slats of light $\frac{1}{2}$ by 6-in. material, although any available widths of stock will do. The slats may be placed close together or separated a few inches for additional springiness. Their distance below the top edge should be approximately 6 in.

About five old inner tubes will be sufficient to form the "springs." They should be of medium size and inflated so that they are almost flush with the top edge. Arrange them on the slats in the best posi-

Y USING old inner tubes in place of upholstery springs, any amateur craftsman can construct an attractive, modern-looking, and thoroughly serviceable studio couch for a fraction of the cost of the commercial article.

The length and width may be varied, but the 16-in. height above the floor should be maintained because it insures the most comfortable knee position for the average person. The sides and ends are made of 1 by 8-in. boards. You will need, for a couch of the size shown, about 37 linear ft. The corners may be joined in any suitable manner—screws, straight nailing, tenoned joints, or even mitered joints.

The corner posts are 2 by 2 by 12 in. Note that they are not set flush with the lower edges of the main boxlike frame, but are kept up a little. The roller casters



Profile and plan view of the couch without mattress or drapes

IT'S EASY TO GET THE RIGHT Current for

You can use a storage battery . . . Make a motor-generator rectifier for use with a lamp bank or step-down transformer, or



If either 32-volt or 110-volt direct current is available, nothing more is needed for operating a plating outfit than a lamp bank to regulate the current

By KENDALL FORD

HOW can I obtain the right kind of current for electroplating at home?" is a question repeatedly asked by readers. Evidently there are thousands of home workers who would like to do electroplating, but hesitate because they think that the process requires some special type of current from a complicated power supply. This is a mistaken notion. While it is true that electroplating does require low-voltage, direct current, the necessary apparatus for producing it can be set up without difficulty by any experimenter. A number of ways of doing so will be described in this and a following article.

It is not necessary to go deeply into the theory and methods of electroplating, because the subject has been covered repeatedly in the past, and the necessary information is available in many books. In brief, a thin layer of one metal is deposited upon another metal by placing the metal to be deposited, called the "anode," and the object to be plated, known as the "cathode," in a suitable solution. Metallic salts for the more common varieties of plating, such as nickel, gold, and silver, may be purchased ready for use from dealers in electroplating supplies, or the solutions for any type of plating may be readily mixed according to the instructions to be found in any standard handbook of formulas.

When the positive pole of a direct-current source is connected to the anode and the negative pole to the cathode, the current flowing through the solution will cause a coating of the anode material to be deposited on the cathode, or object being plated. The current required to plate 1 sq. ft. of metal varies from 1 to 12 amperes, depending upon the plating metal and the solution.

Since the resistance of the solution between the anode and the cathode is quite low, some means must be provided to

keep the current at the correct level for the object being plated. Where a bank of lamps is used, varying the number of lamps in the circuit will control the amount of current. If the current supply is from a low-voltage source, such as a generator, storage battery, or transformer, a small rheostat should be used to control the current.

When 32-volt or 110-volt direct current is available, the arrangement shown in Fig. 1 is both simple and effective. The lamp bank consists of several lamps, the size of which depends upon the current required. For plating small objects, the lamps should be of 5- or 10-watt size so that a fine degree of regulation may be obtained. To determine the polarity of the supply line, place the two leads that go to the plating

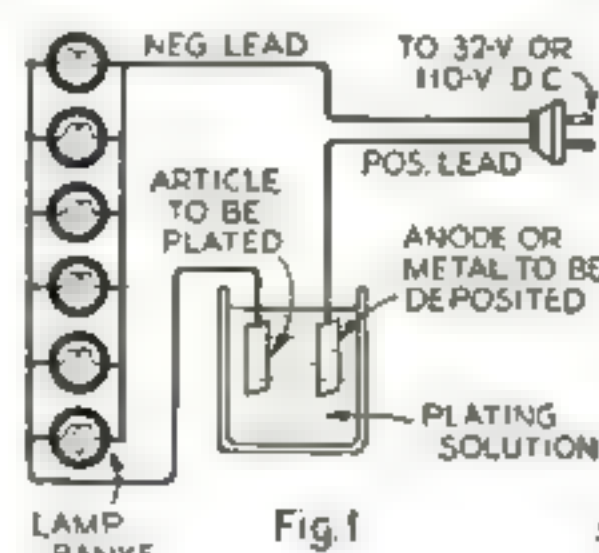


Fig. 1

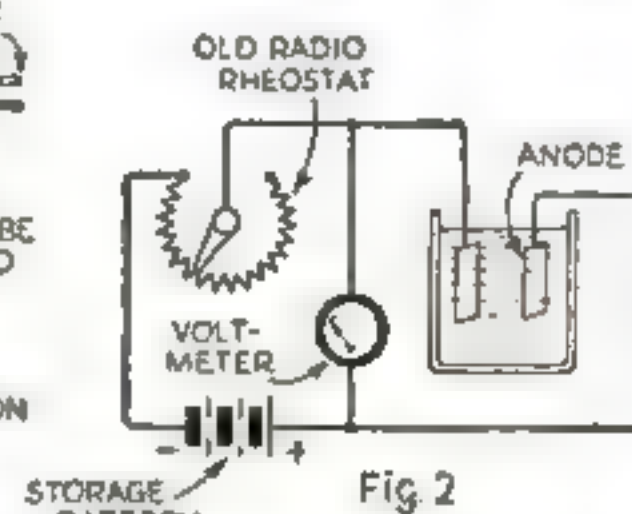


Fig. 2

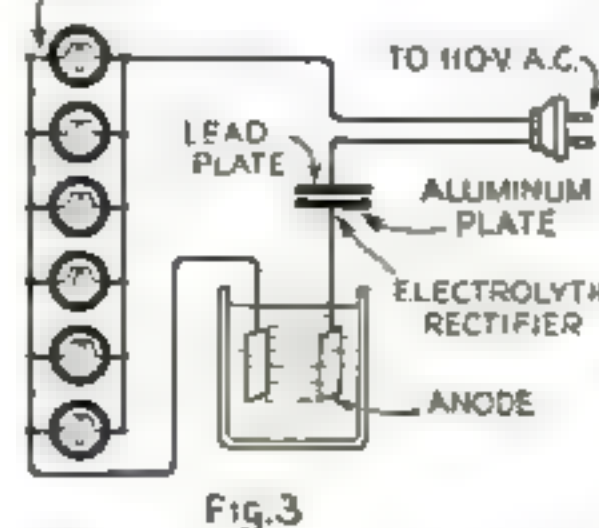


Fig. 3

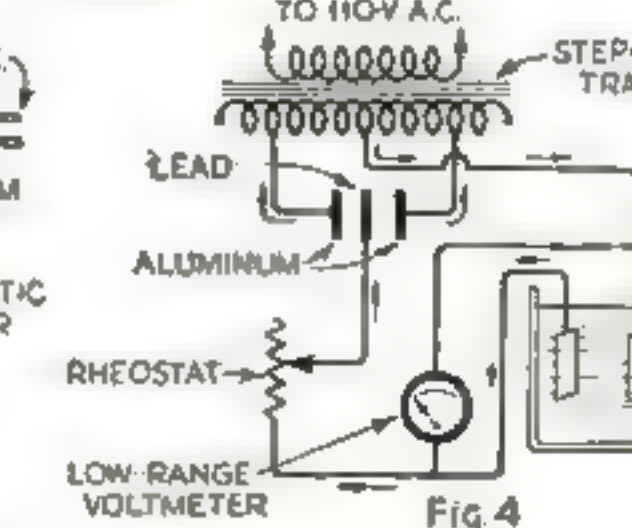


Fig. 4

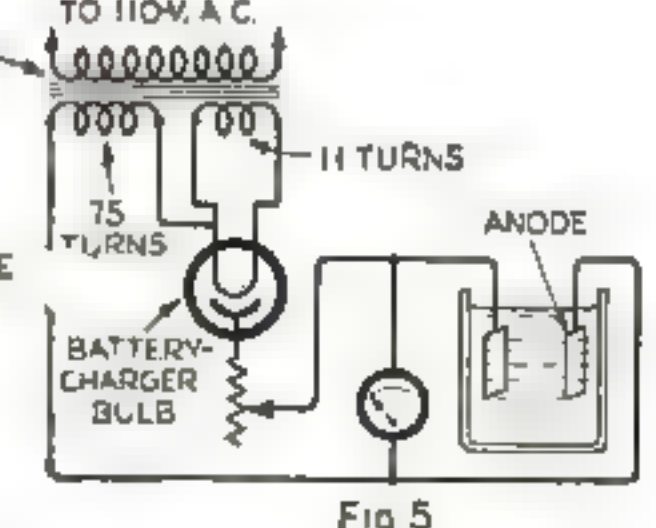


Fig. 5

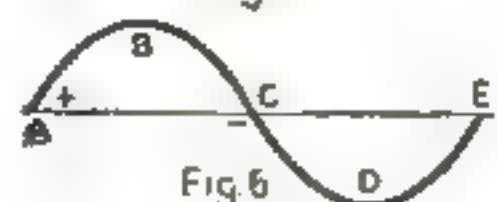


Fig. 6

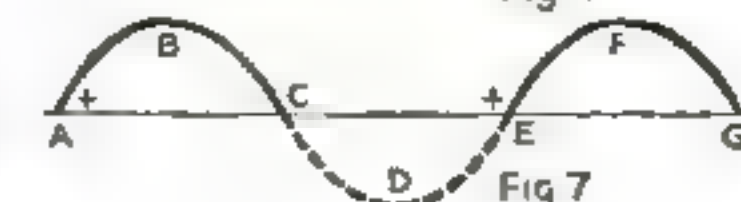


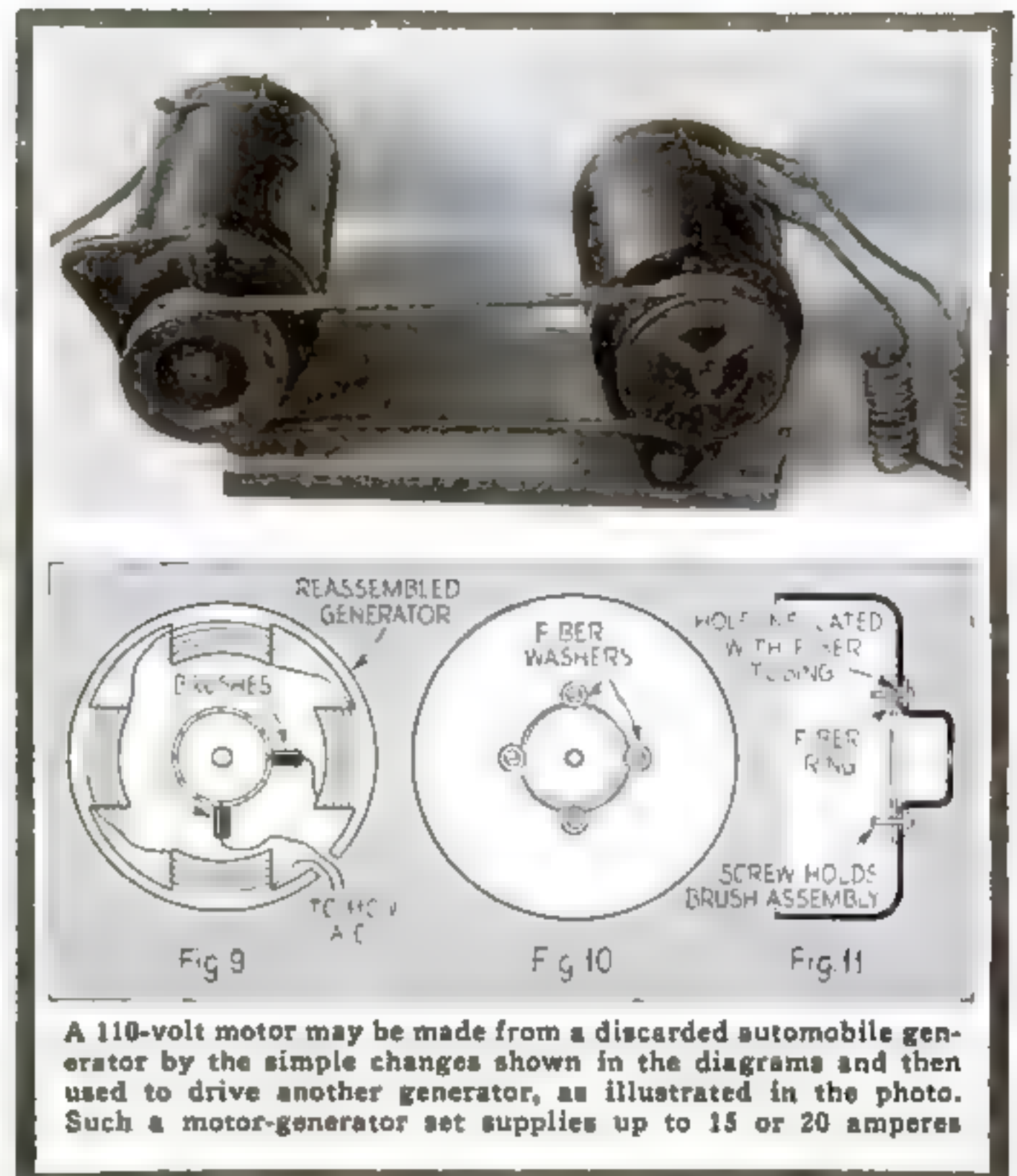
Fig. 7



Fig. 8

A CHOICE OF HOOK-UPS

The storage battery and lamp-bank diagram is given in Fig. 1; battery, rheostat, and voltmeter in Fig. 2; various rectifier circuits in Figs. 3, 4, and 5; and an explanation of alternating, half-rectified, and completely rectified current in Figs. 6, 7, and 8



A 110-volt motor may be made from a discarded automobile generator by the simple changes shown in the diagrams and then used to drive another generator, as illustrated in the photo. Such a motor-generator set supplies up to 15 or 20 amperes

tank in a solution of salt water, and small bubbles will rise from the negative lead.

If small lamps are not obtainable, an old radio rheostat, from 6 to 10 ohms, placed in series with the larger lamps will help to control the current.

The set-up in Fig. 2, using a storage battery, a rheostat, and a voltmeter, makes a satisfactory power plant for electroplating. The rheostat should have a resistance of from 2 to 6 ohms and may be salvaged from an old radio. The voltmeter should have a range of 0 to 6 volts, direct current. While a voltmeter is essential for fine

ELECTROPLATING

set from two old auto generators . . . Construct an electrolytic adopt other simple and comparatively inexpensive methods

work, if one is unobtainable the correct amount of current flowing may be determined approximately by observation when the object to be plated is first placed in the solution. If the object turns dark or black immediately, the current is too high and must be reduced. If the object is not completely covered with a thin coating of the anode material within one minute after being placed in the solution, the current should be increased.

If one of the leads from the storage battery is equipped with a battery clamp, further regulation may be obtained by using one, two, or three cells of the storage battery. To avoid confusion over the amount of current being used and the voltage indicated on the voltmeter, it should be remembered that the voltmeter readings will vary directly with the amount of current flowing between the anode and cathode. Directions for electroplating generally specify the voltage at which the work should be done, the current automatically being correct for that particular voltage.

Where a considerable amount of current is required for plating large areas of metal, a salvaged automobile generator is recommended. When driven by a suitable motor, these generators are capable of delivering a current up to 15 or 20 amperes, which is more than sufficient for the average experimenter's needs. If a driving motor is not available, an excellent motor for the purpose can be made from another automobile generator. In selecting the generators, make certain that they are in good condition, particularly the commutators and bearings.

Practically any type of automobile generator may be converted into a motor by the following method. The drawings (Figs. 9, 10, and 11) illustrate the Ford model-T type because it still seems to be the kind easiest and cheapest to obtain. The same general changes in the generator will be required, regardless of the make, so the experimenter should have no difficulty in applying the instructions to any

particular type he is able to obtain.

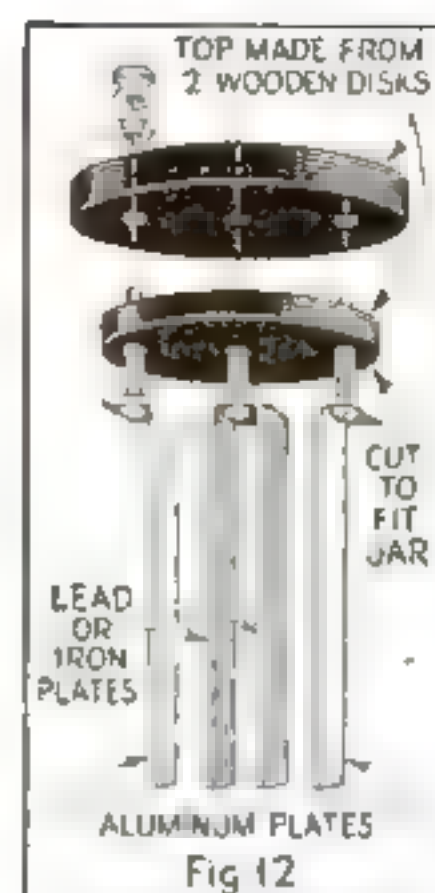
Remove the brush-holder ring from the end bell, and the third or smaller brush and its holder from the brush ring. Enlarge the screw holes in the end bell and insulate with fiber tubing (Fig. 11). Make four fiber washers to insulate the heads of the brush-holder retaining screws from the end bell as shown in Figs. 10 and 11. Cut a fiber ring to insulate the brush-holder ring from the end bell. The procedure outlined may vary with different types of generators, but the main purpose is to insulate the brush holder assembly from any part of the generator frame.

REASSEMBLE the generator and connect as shown in Fig. 9. One end of the field connects to a line wire, the other end to a brush, and the remaining brush lead to the remaining line wire. The brushes should be exactly 90 deg. apart. Since the leads from the remodeled generator are subject to considerable vibration, it is advisable to attach flexible wires to the brush and field leads that connect to the line wires.

The motor may be connected to the generator with a flexible coupling or by means of the original driving pulleys and a belt. Either alternating or direct current, 110 volts, will serve as the supply. The direction of rotation may be changed by merely interchanging the two wires that connect to the brushes. The generator is connected to the plating circuit as shown at Fig. 2, with the generator replacing the storage battery.

A salvaged radio rheostat having a resistance of from 6 or 10 ohms will serve to regulate the current if only small articles are being plated. If several amperes are required, it will be necessary to provide a rheostat large enough to carry the current without overheating.

When the plating voltage and required



SIMPLE ELECTROLYTIC RECTIFIER
To make this full-wave rectifier, two strips of aluminum and two of iron or lead are fastened to a wooden jar top. Before assembly, the top must be treated with acid-proof paint.

current are known, it is an easy matter to calculate the resistance of the rheostat. The plating voltage is subtracted from the supply voltage, and the remainder divided by the required current in amperes. The result will be the value of the resistance in ohms. For example, a plating tank requiring 3.5 volts and 5 amperes is connected to a generator delivering 6 volts. Subtract 3.5 volts from 6 volts and divide by 5, which gives 0.5 ohms as the resistance of the required rheostat. Actually, it would be better to select a rheostat with a range from 0 to 2 ohms so that it could also be used to plate articles requiring less or greater amounts of current.

For the purpose of calculating rheostat sizes, the approximate current densities per square foot of surface for the following plating materials will be found suitable for home workshop use:

Chromium	5 to 10 amperes
Copper	6 to 12 "
Nickel	4 "
Brass	6 to 8 "
Bronze	6 to 8 "
Silver	2 "
Gold	1 1/2 "

When 110-volt alternating current is available, a simple electroplating current may be obtained by using a bank of lamps and an electrolytic rectifier, as shown in Fig. 3. If more efficiency is desired and a greater current output required, the arrangement of Fig. 4 is recommended. This consists of a *(Continued on page 107)*



SWITCHBOARD FOR PLATING

Current from a storage battery may be regulated by means of a rheostat and voltmeter, which are best mounted on a convenient panel. A back view of the panel is shown above, and the complete set-up for plating at the left

PORTABLE EASEL FITS BACK OF CHAIR



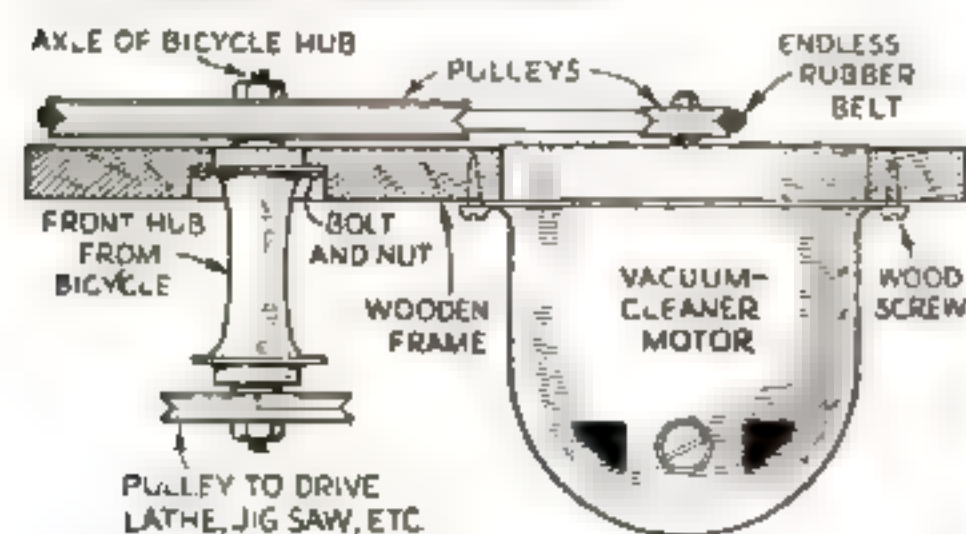
The easel holds a drawing board at a convenient height, with clearance for one's knees

ALTHOUGH light in weight and simple to construct, this easily made portable easel will support the ordinary work of any amateur artist or draftsman. It is merely hooked over the upper back rail of any ordinary chair. There is nothing underneath to get in the way of the knees, and the easel takes up almost no room



VACUUM-CLEANER MOTOR ADAPTED FOR SHOP USE

VACUUM-CLEANER motors are comparatively easy to obtain second hand, but because of their high speed (8,000-10,000 r.p.m.) are not suitable for driving most home workshop machinery without some form of speed reduction. The illustrations show how a countershaft may be added to the motor, making it a compact power unit to be used in place of a regular $\frac{1}{4}$ h.p. motor. The basis is a bicycle front hub, on the axle of which are mounted a large and a small pulley, one at each end. The motor and countershaft are then arranged on a suitable wooden board. The belt may be a round leather one, but a rubber vacuum-cleaner belt will give better results.—CARL FROEN.



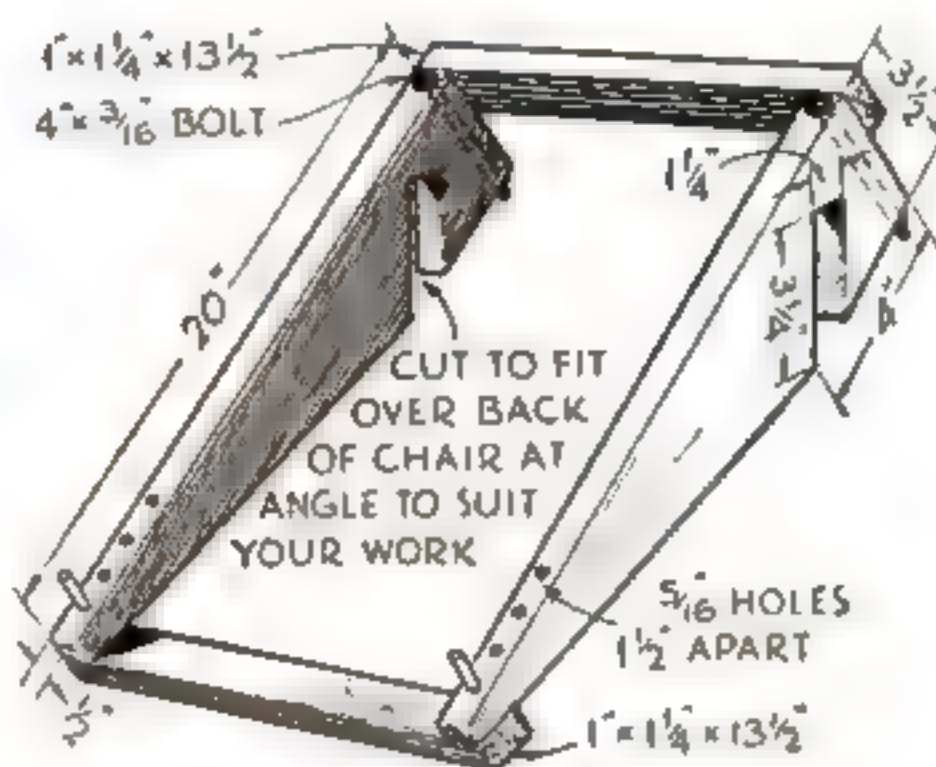
A bicycle hub and two pulleys are used as a speed reduction unit with the discarded motor

when not in use because it can be hung on the wall.

The sides are cut from 1 by $3\frac{1}{2}$ -in. stock; the other two pieces are what is known as "blind stop" or 1 by $1\frac{1}{4}$ -in. material. Fasten the frame together with nails or screws. For adjusting the height of the work, drill four or five $\frac{5}{16}$ -in. holes $1\frac{1}{2}$ in. apart and make pegs to fit.

If the lumber at hand is strong hardwood that does not split easily, it is not necessary to reinforce the slots that fit over the back of the chair, but if you are using pine or other softwood, drill a $\frac{1}{4}$ -in. hole in each side just above the "dap" and insert a 4 by $\frac{3}{16}$ -in. bolt. This will prevent splitting when pressure is exerted.

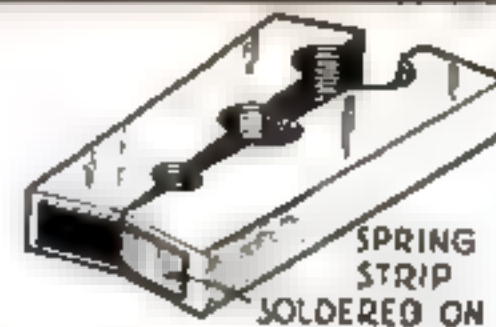
The width may have to be varied to suit the chair you intend to use, but the suggested dimensions apply to most wooden chairs.—EDWARD P. RAMAGE.



How the framework is made. The reinforcing bolts are necessary only if the wood is soft



This tap guide, being in two parts, can be clamped directly around the tap, thus saving considerable time



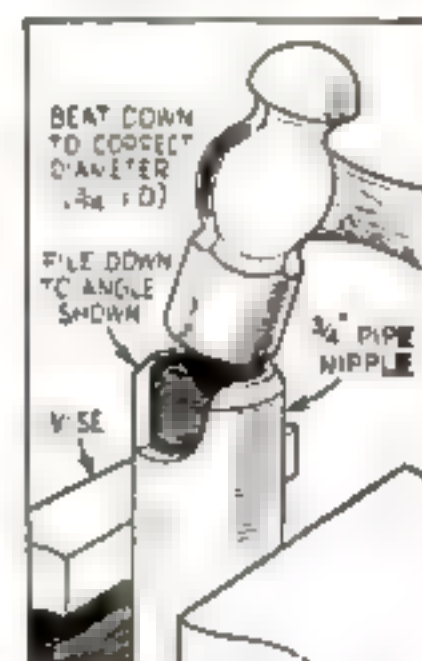
TWO-PIECE GUIDE HELPS IN STARTING A TAP

IT IS good shop practice to make use of a guide for starting a tap vertically in a drilled hole, and the ordinary guide consists of a metal block with a tapped hole through it. This serves the purpose adequately, but it necessitates the extra work of running the tap through the guide before beginning the job and removing it when the work is finished. An improvement is to make the block in two parts. Simply clamp the two pieces in the vise, then drill and tap the guide holes; do not make the holes and saw the block afterward. A strip of spring metal soldered to the ends of the two halves, as shown in the drawing, adds to the convenience of handling them.—W. W.

DOWELS SHAPED WITH SHARPENED PIPE

SCRAPS of wood can be made into dowels of any desired size with a tool formed from a pipe nipple or short piece of pipe. In the case illustrated, $\frac{3}{4}$ -in. dow-

els were needed, so a pipe of approximately $\frac{3}{4}$ -in. inside diameter was used. File one end of the nipple to the angle shown in the sketch, hammer in the filed



The dowel-making tool and, at left, how the rough stock is driven through

edge until it measures exactly the desired size, and grip the pipe vertically in the vise. Rip short lengths of stock for the dowels to $\frac{3}{4}$ in. square, or whatever size is wanted, and then dress off the corners to form an octagon shape. If the wood is hard, plane off the eight corners to make the stock more nearly round before driving it through.—R. O. LISSAMAN.

LEAD-COVERED TRAY HOLDS JARS OF SOLDERING ACID

A METAL tray covered with sheet lead and holding three small mayonnaise jars makes a convenient acid tray for the shop. It can be made in various ways to suit one's convenience and the work to be done, but the holder illustrated at the right is of triangular shape and rests on three legs of scrap metal. A short rod with a loop in the top serves as the handle. Thin sticks of solder may be carried by bending them as shown.—J. C. COYLE.

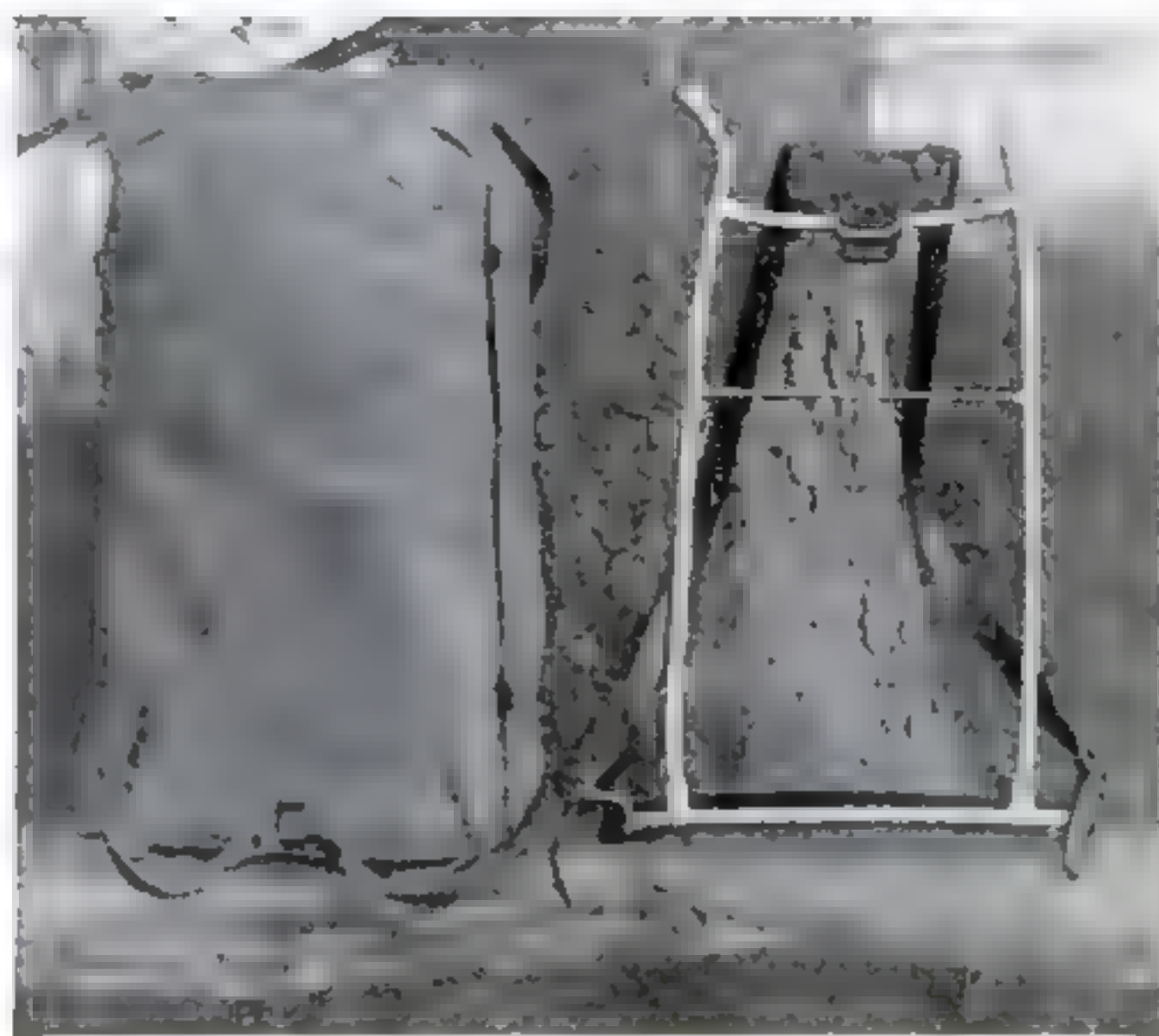
Soldering acid, which is dangerous if spilled, can be carried safely about a shop in small mayonnaise jars. The tray is made acid-proof with sheet lead



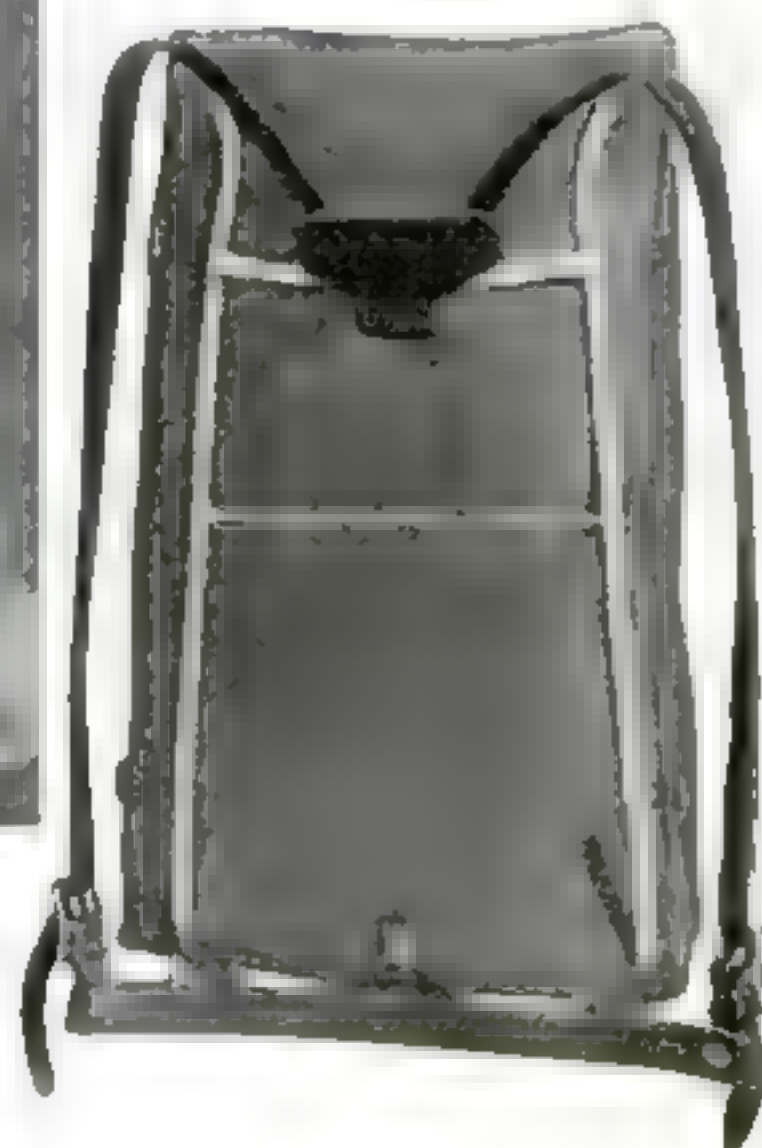
Lightweight BACK PACK

Tailored to Fit Your Body

By
ARTHUR E.
MACNEILL



The joining faces of sack and frame and, at left, how the sack is worn. The shoulders have perfect freedom to move



Assembled pack, showing triangular pad that rests between the shoulder blades

THIS mountain pack has been specially designed to carry the outfit of a camper, hunter, or hiker who prefers to travel light. The expense for materials is about \$2.50, and the finished pack is more comfortable, convenient, and better looking than some commercial types costing from \$15 to \$20. That is because it is actually tailored to fit the body. Weighing only 5 oz. more than a common canvas pack sack, it distributes the burden on the back and hips so scientifically that the fatigue of hiking, even over winding mountain trails, is greatly lessened; and, of course, it is equally valuable for trips through level country.

The ordinary pack has many disadvantages. The straps, which are often of

webbing, invariably curl up when wet and saw ridges into the shoulders. Many straps are too wide, and the edges cut into the skin while the tender tissues under the armpits are often tightly compressed. The pack usually fits too snugly against the back and is correspondingly uncomfortable. These and other disadvantages are all eliminated when man's anatomy is studied and the pack correctly designed. The frame to be described distributes the load and keeps the pack from rubbing against the back.

The framework may be made of any light but strong metal tubing that will not rust or corrode. The author selected aluminum of the dimensions given in the list of materials at the end of the article. If larger tubing is used, much additional strength is obtained at the expense of an

extra ounce or two. The metal straps at the joints may be cut from thin sheet aluminum or from an old or inexpensive aluminum utensil.

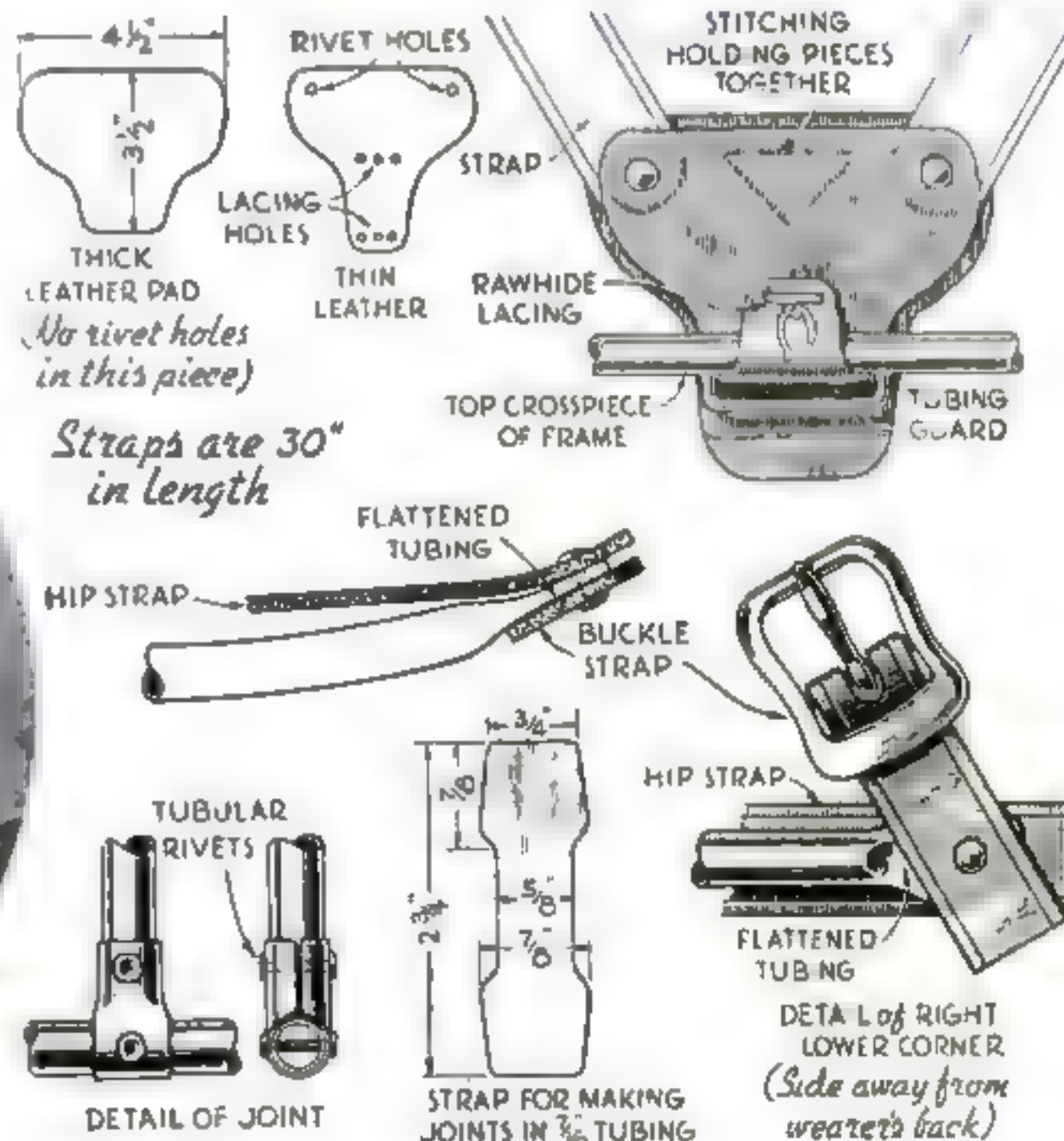
All the leather used should be made soft and pliable by soaking in neat's-foot oil. The cloth may be obtained from an outing supply house. The best shade for this purpose is dark green. The sewing can be easily done on a sewing machine if a heavy needle and about No. 12 cotton thread are used.

In constructing the frame, first bend the tubing as shown to fit the back. The best length for the uprights is the distance from the lower tip of the ear to the belt line—about *(Continued on page 105)*



The heavy aluminum tubing for the uprights is easily bent with the aid of a jig made as shown below. At the right are drawings of joints, the triangular leather pad, and other details

Before being bent around the tubing, the aluminum straps must be carefully cleaned and "tinned" with aluminum solder. Note joint in the background



Miniature Trees

to dress up your MODEL RAILWAY SYSTEM

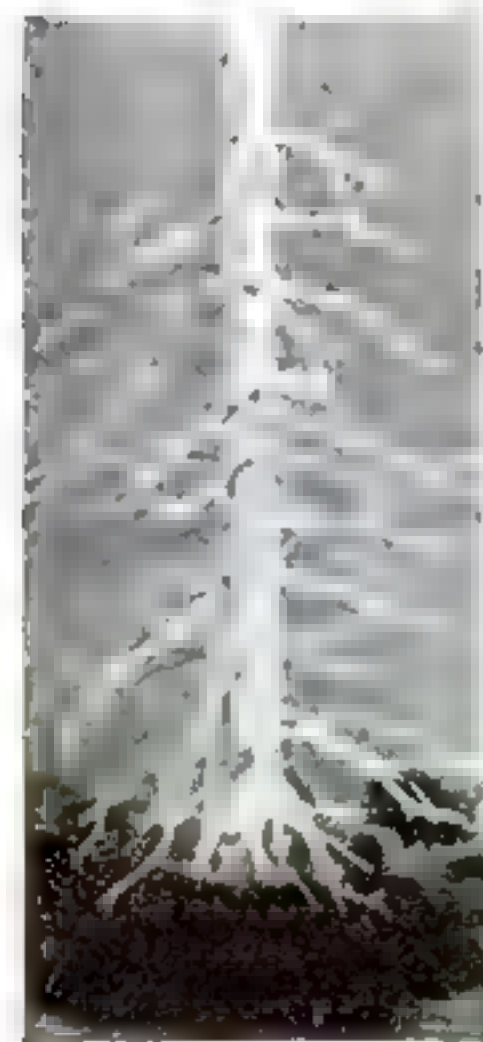
By Edwin M. Love

NO MATTER how accurate your model railway layout may be, it is unconvincing in appearance unless the scenic effect is equally good. Trees roughly thrown together from chunks of sponges, or vamped up from twigs purloined from shrubbery and having leaves that are grotesquely out of scale, are an eyesore and cheapen everything else.

The accompanying illustrations show with what realism model trees can be made. They actually require less time to construct than buildings and other accessories, but they cause more favorable comment, perhaps because trees are usually so poorly done.

Aside from palm trees, there are only three types of tree growth to be considered in model work: the wide-spreading and open-limbed variety, such as oaks and birches; the compact tree with sagging branches, such as firs and spruces; and matted trees with upward-growing branches, such as cedars. Books describing the varieties of trees are available in public libraries.

Oak branches tend to come out from the trunk at right angles. Roughly speaking, the tapering of the trunk is caused by removal of material by the branches. Of course, branching roots enlarge the base. To start the tree, cut wires 1 in. longer than the scale height, making a bundle as large as the diameter of the trunk, and bind together with fine wire wrapped below the first branch. Holding the bundle upright in a vise, bend down a few wires to form a branch,



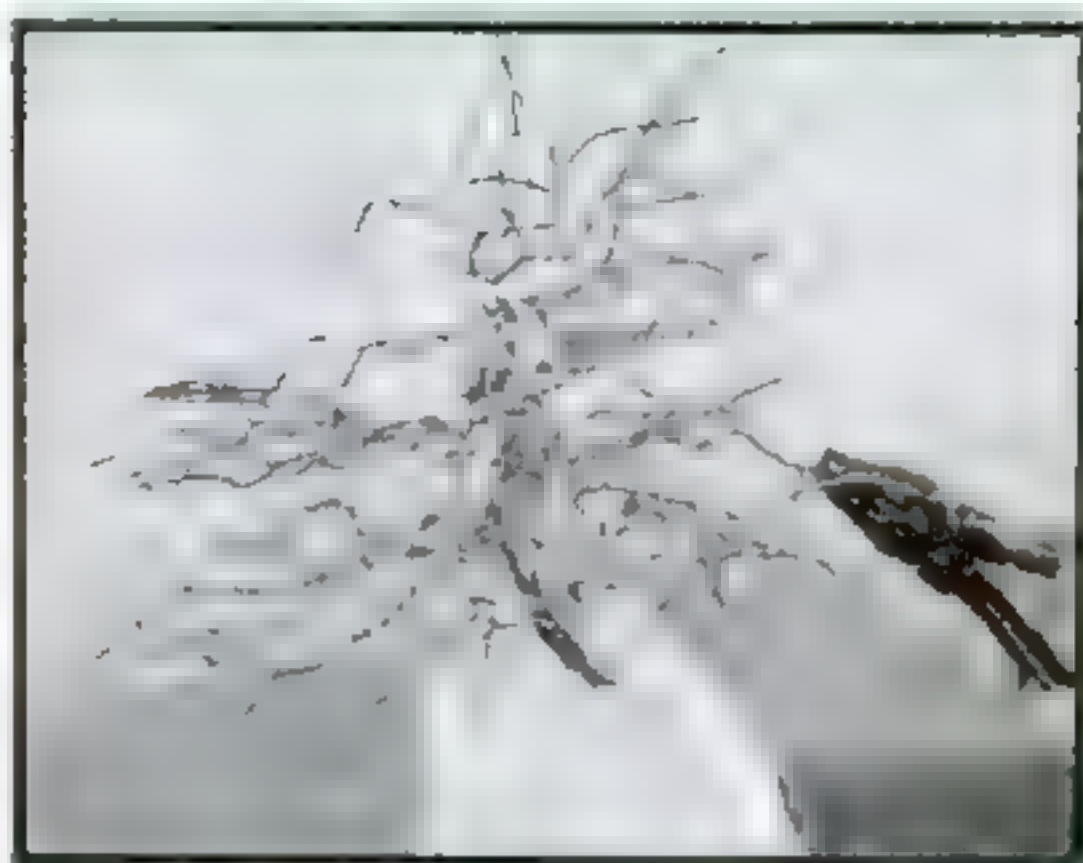
The skeleton of a fir tree consists of wires inserted in a tapering stick. After foliage is added, the tree looks like the one at the right



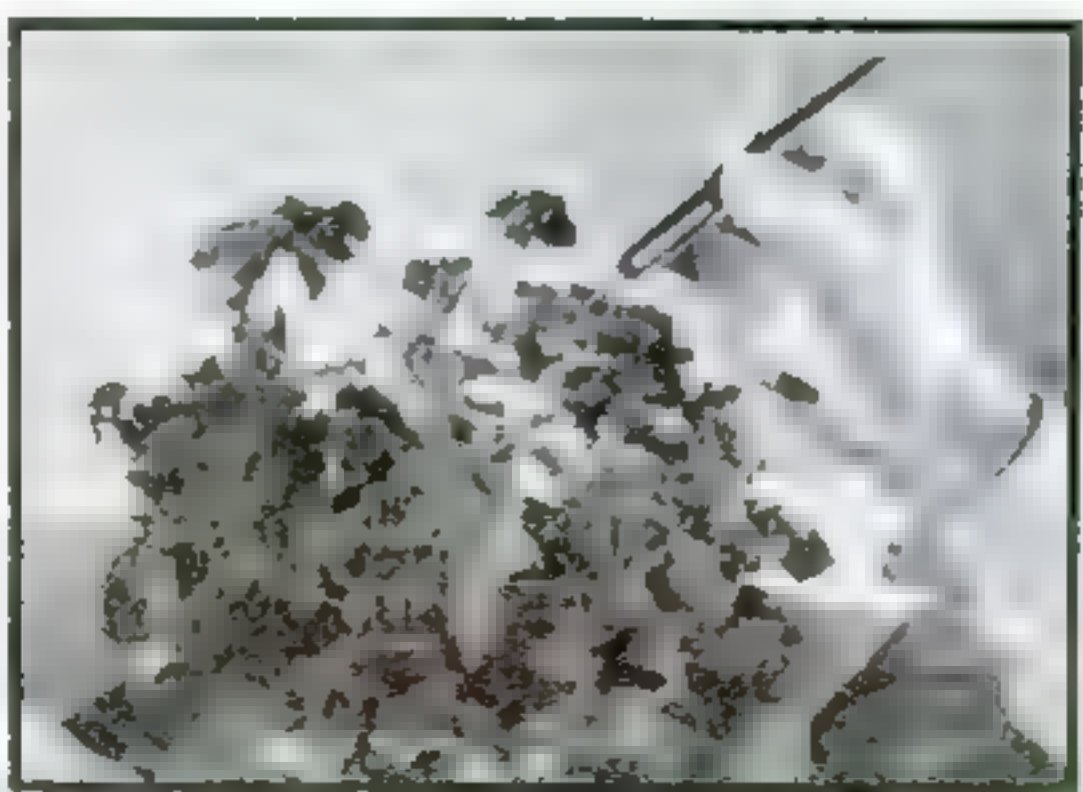
Diminutive trees made of wires and stained bread provide picturesque backgrounds that any model railway fan can easily construct



In building the sturdy white oak, extra wires must be added so that the trunk does not taper too fast



The limbs and secondary branches are twisted with pliers; then the tree is pruned to a balanced shape



Bits of stained bread are attached to the ends of the branches and built up to resemble thick foliage

twisting them enough to hold together. Add another binding wire just above, and bend down another branch, varying the size by using more or less wires. Continue this process, staggering the limbs and being careful not to space them too evenly. As there is space between the wires in the bundles, rather than solidity as in a real tree, the branches reduce the trunk too rapidly, so that additional wires must be tied in from time to time to add bulk. At the top the trunk separates into branches.

Now twist the limbs with pliers up to the points where secondary branches start. Introduce bends and offsets in oaks, but keep the limbs nearly straight in birches. Bring out the smaller branches, twist them directly, and divide them into twigs where practicable. Binding wires are not needed. Then prune the tree to a balanced shape, and bend out three or four sturdy roots at the base, the stub ends of which will be buried in the "soil."

Paint the skeleton with one or two coats of gesso made by diluting orange shellac with an equal quantity of alcohol and mixing with whiting to form a thin batter. Dry color may be added to give the trunk and branches the desired shade.

While sponges can be used for foliage, day-old bread is less expensive. An unsliced loaf will make a large tree. Lay large fragments in a tray and pour over them water colored with green shingle stain or other green dye and made adhesive with a small quantity of liquid glue. A few drops of some *(Continued on page 100)*

Step-by-step instructions for a
variety of beautiful ways to finish

Wrought Iron and Ginger Jars

By RALPH G. WARING

BECAUSE we are fond of ginger in our fruit salads, cakes, and candies, Mrs. Waring and I have tried a number of different brands. We were fortunate enough at last to discover a fine ginger from China—a large root type, soft boiled in heavy syrup and shipped in small gray pottery jars of typical Chinese form.

As a designer, the shape of these jars had an instant appeal to me, so that when several had accumulated, I started to make use of them. We like plants and flowers, and usually have plants hanging in our windows throughout the year. Hence it seemed only natural to convert these ginger jars into holders for vines and flowers.

One ivy, rooted in a burnished copper bowl which hung in a north window, grew too large for the dining-room window. A wall-bracket panel of colonial motif was therefore designed to supplement the copper bowl, as shown at the right, and the wrought-iron frame is now fastened to the wall of the summer house, in pleasing contrast to the white rough-finished panel.

Having made a variety of ginger-jar holders, as well as this large panel, all of wrought iron, I was faced with the choice and application of suitable finishes. I knew that from the time of the crusades or even before, artisans were able to develop finishes for iron and steel that have endured to this day, almost proof against rusting and decay.

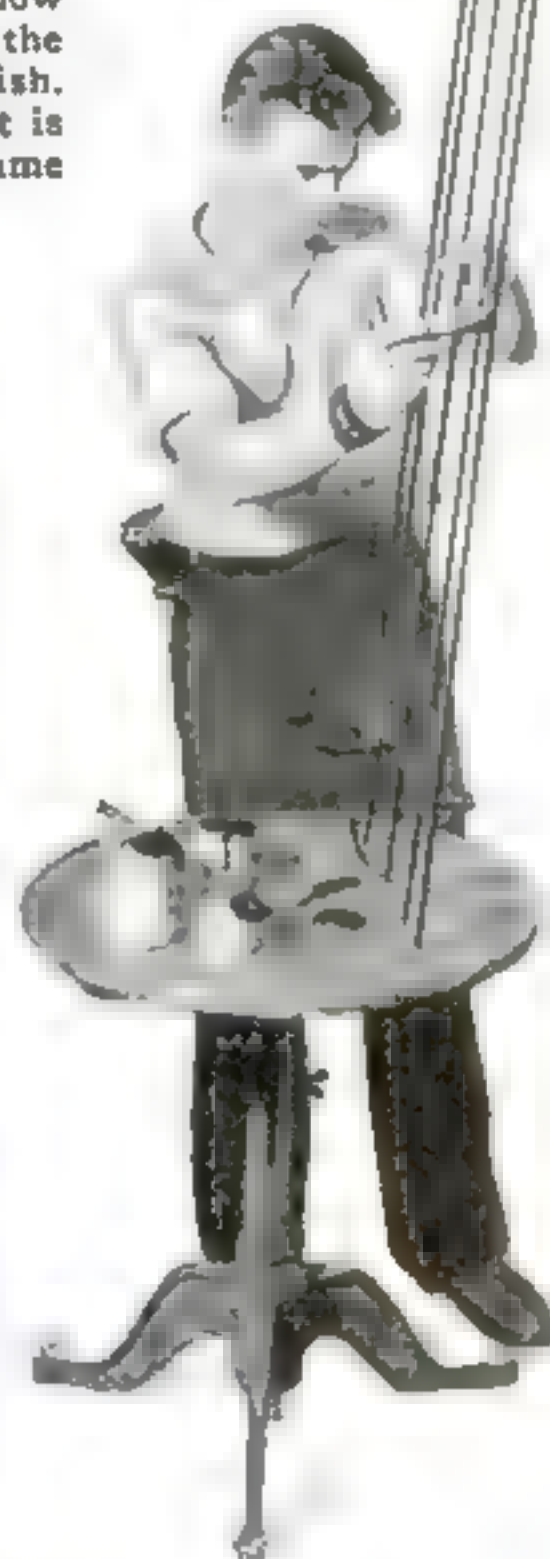
Among these finishes was the color now known as "forge black." The metal is first well cleaned by sanding with No. 00 emery cloth or steel wool, then washed with denatured alcohol (shellac grade) to remove handling grease, and dried. To prevent finger spotting the cleaned metal, it is advisable to use clean cotton gloves, which should be washed as often as they become soiled.

As soon as possible after drying, the metal is coated with linseed oil by brushing, dipping, or spraying, and then heated over the

Eggshell black enamel makes an effective finish for the ivy ring stand. In the front center foreground is a jar with a jade green glaze, although any color could be used



Applying a sponge glaze previous to blending out with a brush. Note how the fingers are held inside of the bowl to avoid spotting the finish. The decorator below at the right is working on a colonial panel frame



The metal is cleaned with emery paper and denatured alcohol; then lacquered and finished with enamel by means of a rag pounce

forge with the air blast on, so that free carbon is added to the burning oil, which gradually assumes an enamel-like form. When the oil stops smoking, but without warming the iron above a black heat, the process is complete, except for wiping with a cloth to remove free soot after the metal has cooled. This method leaves a warm, dull black finish.

Since all the designs illustrated were done in cold metal with no forging, other methods of finishes are equally applicable. The materials required are dull black brushing lacquer and dull black fast-drying enamel; five other fast-drying enamels in ¼-pt. cans—jade green, coffee brown, Delft blue, white, and Chinese red; ½-pt. clear brushing lacquer and some lacquer thinner; denatured alcohol; turpentine; a little No. 2 steel wool; a pound each of FFF pumice stone and rottenstone; and several sheets of No. 4/0, 2/0, and 1/2 emery cloth. Several small soft-bristle rubber-set brushes of widths from ¼ to ¾ in. and a 1-in. curved handle rubbing brush complete the list.

For our fireplace equipment we decided to use a so-called "armor bright" finish on the handles of the fire shovel, tongs, and log fork, with black on the shovel, tips, prongs, and fire screen. Armor bright, like forge black, is a very old metal finish and a replica of the color given

(Continued on page 96)

Take-down Bevel Square Aids in Shingling Valleys



Once the adjustable bevel square has been set to match the angle of the valley, as illustrated in the oval, it can be used as shown above to guide each course of shingles. It is held in position with the knees, and the butts of the shingles are laid along the edge

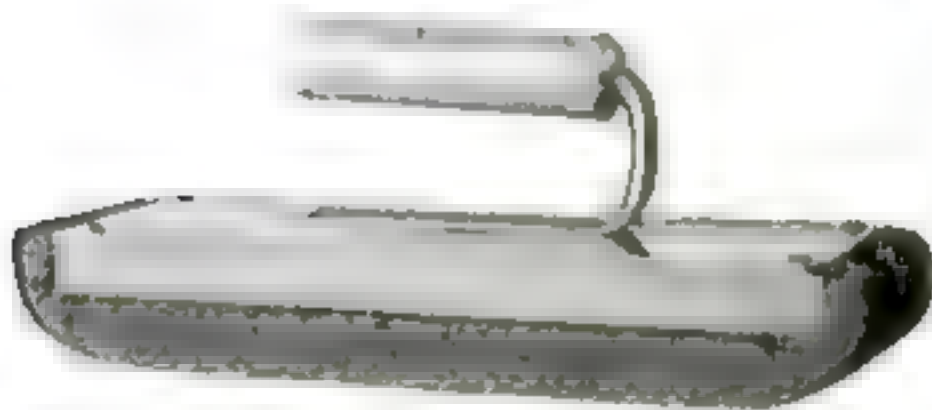
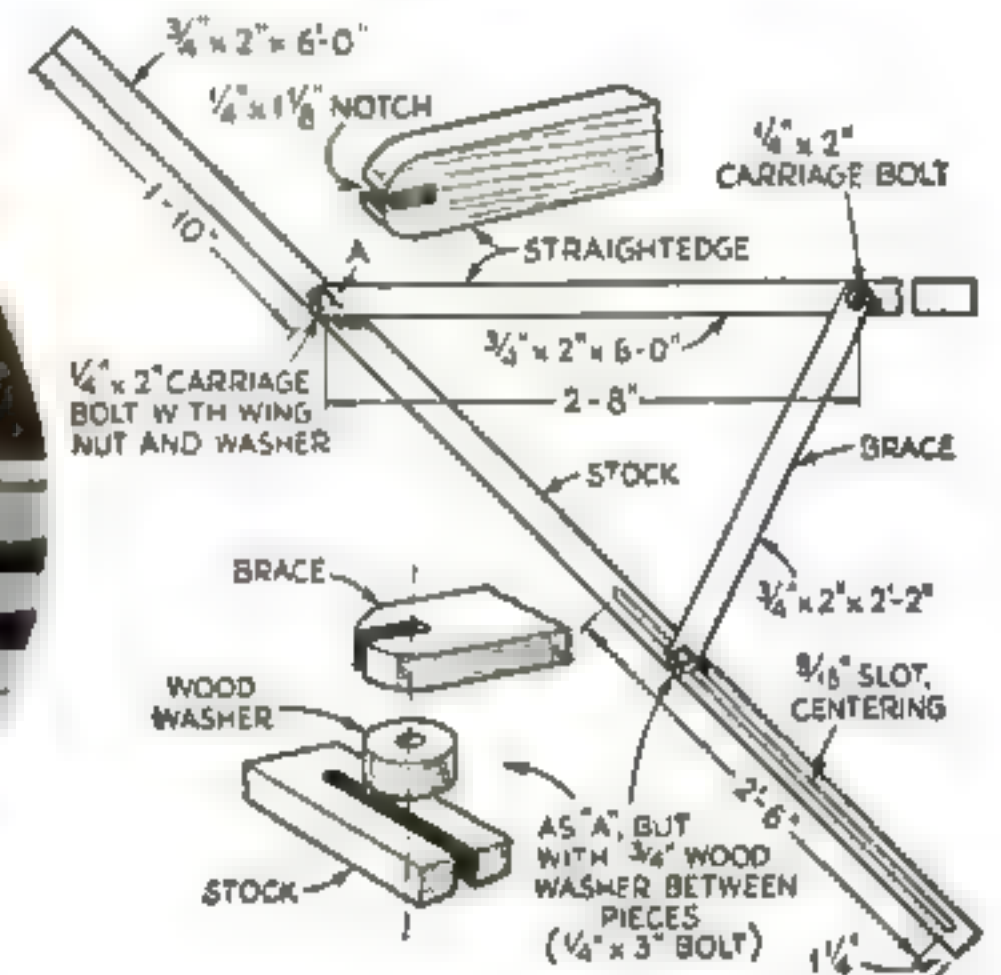


VALLEYS are always troublesome to shingle because each course is longer than the one below. As a result the shingles next to the valley must be placed by guesswork, since there is no course below at this point to catch the hatchet gauge. The slight errors introduced in each course, when added together, often cause the courses to run up or down after a time, and a straightedge or chalk line must be used to correct the trouble.

This waste of time and effort may be prevented by using a simple take-down bevel square. It consists of a straightedge 6 ft. long, a stock of the same length with a pivot bolt and a

slot in which a bolt slides, and a brace. The end of the straightedge pivots on the stock and is notched for quick removal without taking out the bolt. One brace end is bolted to the straightedge, while the other is notched to clasp the sliding bolt in the stock. A wooden washer between the brace and stock make up for the thickness of the straightedge.

To use, lay the stock in the valley near the top, adjust the straightedge along the ridge, and tighten the wing nuts. The device can then be laid at any point in the valley and held with the knee while checking the courses, drawing a pencil line along the straightedge, or resting the shingle butts against it—E. M. L.



A SOFT SANDING BLOCK FOR CURVED SURFACES

DIFFICULTY is sometimes experienced in eliminating all edge marks when sanding curved surfaces. Many cabinet-makers use a piece of cork as a sandpaper block, but unless the surface is nearly flat, even this is often too hard. An efficient sander for this purpose is shown above.

Obtain a plasterer's rectangular trowel, drill a screw hole in each corner, and cut a 1/2-in. piece of pine to the face dimensions of the metal. Slice an ordinary rubber kneeling pad lengthwise down the center, place both pieces on the wood, and tack the ends to the ends of the block. The metal of the trowel is then bent slightly convex and screwed to the wood. The ends of the sandpaper are gripped between the wood and metal.—WALTER K. MOSS.

DIVIDERS USED TO MARK PLANKS ON MODELS

INSTEAD of using a flexible straightedge for marking hull planks on ship models, I have found that a pair of dividers suits the purpose better. I first set the dividers to the width of a plank and, holding one leg on top of the bulwarks, mark the first plank. For the second plank I set the dividers to twice the width and so on. The lines of planking stop, of course, at the copper line. If the cap rail has been put on, an allowance must be made for that in marking the first plank—G. S. GIRARDET, JR.

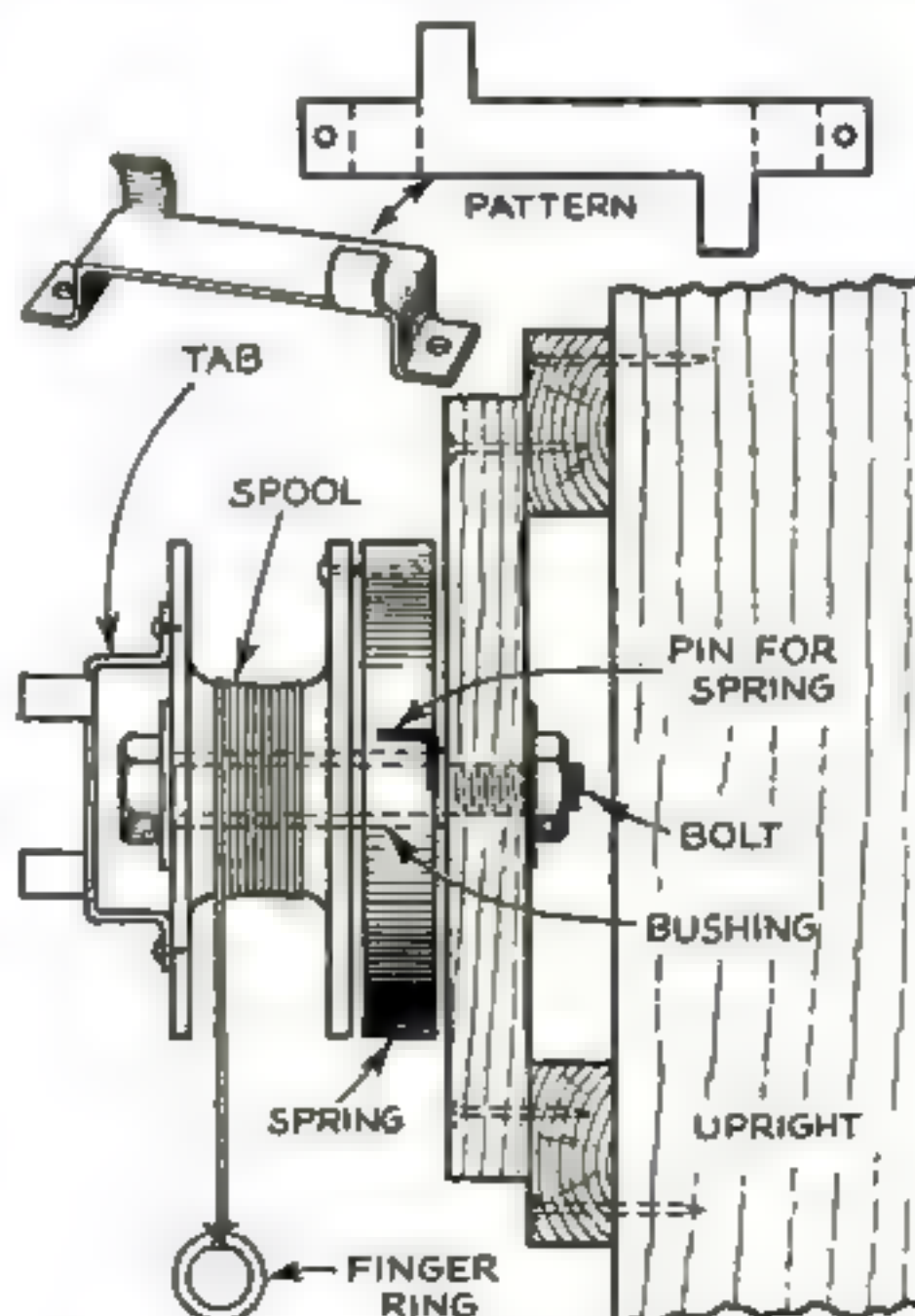
PULL ON CORD UNSCREWS GREASE GUN

IN DOING an automobile grease job with the usual type of pressure gun much time is wasted in turning back the screw plunger so that a fresh charge of grease may be put into the barrel. To save this unnecessary delay, a simple device can be made to run it back quickly.

A long machine bolt with a bushing slipped over it is mounted on a simple wooden frame, which is then fastened to the wall near the grease rack. A small



The grease-gun plunger is run back for a new charge by giving the cord a single long pull



How the spool, clock spring, and tabs are assembled, and a pattern and sketch of the tabs

metal or wooden spool and a spiral spring, taken from an old clock, are slipped over the bushing. To the outside of the spool is attached a piece of sheet metal shaped as shown, with tabs bent over to engage the handle of the grease gun. The inside end of the spring is fastened to a right-angled pin that is threaded or soldered in a small hole through the bushing and bolt, and the outside end is attached to another pin protruding from the side of the spool. A length of stout cord is fastened inside the spool and wrapped several times around it.

To unscrew the plunger, put the handle in place against the spool and pull the cord, which completely runs out the screw. By removing the gun and releasing the cord, the spring, which tightens as the cord is pulled, will wind up the cord ready for use again.—W. C. W.

NATIONAL HOMEWORKSHOP GUILD SETS UP Program Service Bureau

It will supply clubs with information on speakers, demonstrations, and moving pictures, all available without charge



Like many of the clubs in the Guild, the Dover (N. H.) Homecraft Club is hard at work making toys to be given away at Christmas

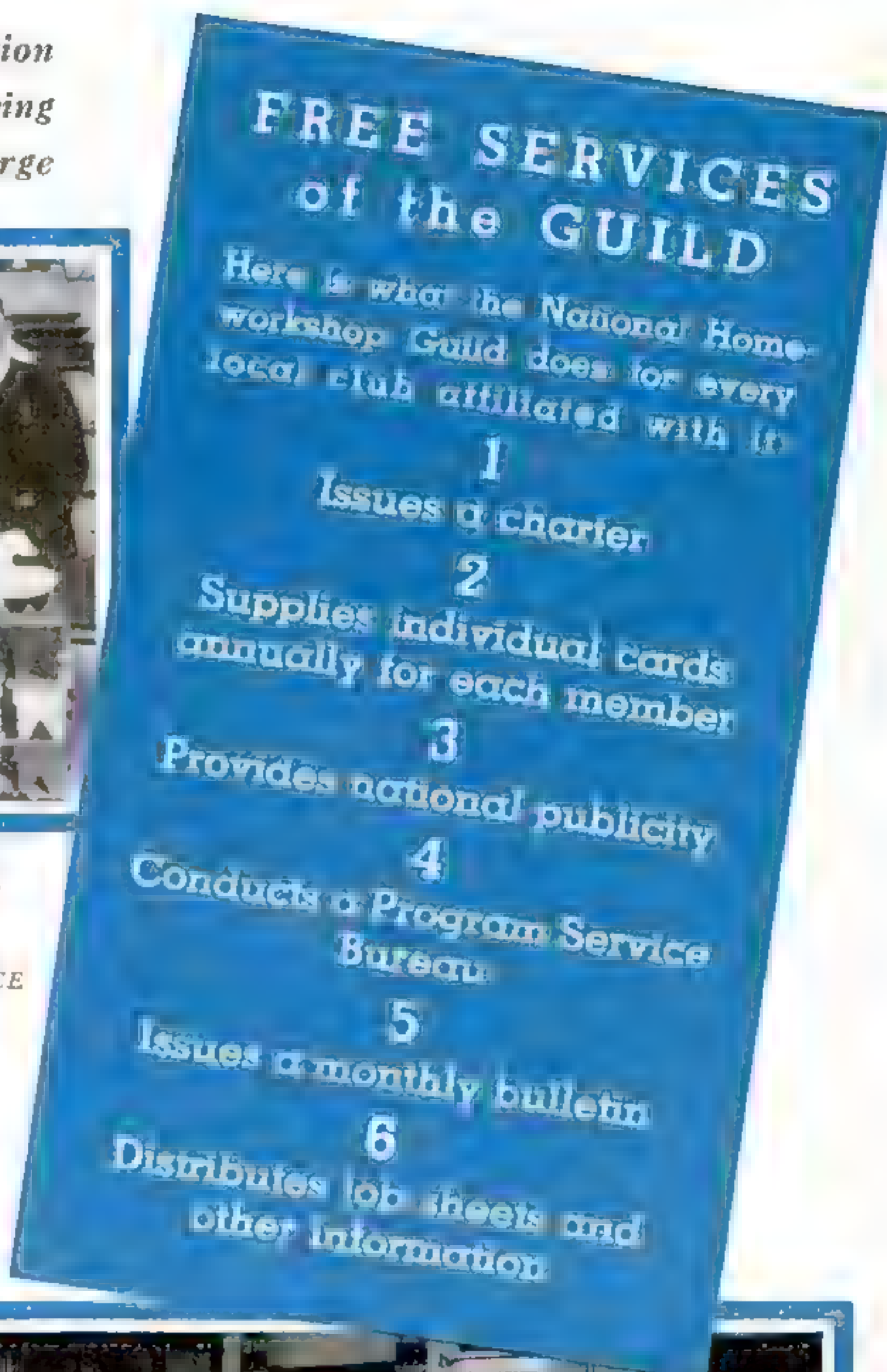
AFTER an exhaustive survey which began last spring, the National Homeworkshop Guild this month launches its new Program Service Bureau. Through this bureau the Guild is prepared to aid its member clubs as never before. The services now available are, indeed, by far the greatest and most complete of their kind in the entire home workshop field.

The new bureau is the outgrowth of the answers received to a question all the local clubs in the Guild were asked: "In what way can the Guild be of most help to you?" The answers in a majority of cases were that the clubs wanted aid in arranging better, more informative, and more interesting programs. They wished to make their meetings so helpful to the members—so encouraging, stimulating, and valuable—that everybody would turn out for fear of missing something worth while. But where could they get program material of this quality?

The Guild undertook to find out and has been working steadily at the task for the past six months. As a result, its new Program Service Bureau now has a long list of educational motion pictures that can be borrowed free, and another list that tabulates more than 100 home workshop authorities throughout the United States and Canada who are willing to address local clubs on a wide variety of subjects. A number of leading manufacturers in the home workshop field are cooperating by providing demonstrations and booklets.

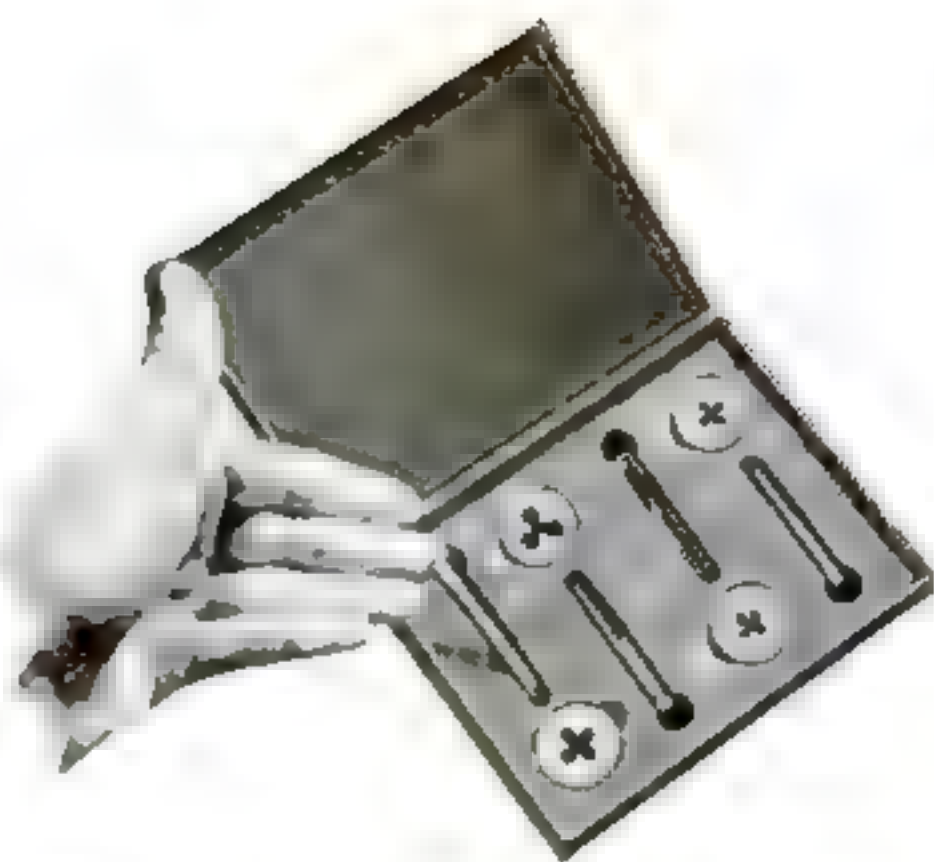
These free *(Continued on page 98)*

Official Magazine
POPULAR SCIENCE
MONTHLY



Exhibition of craftwork by members of the Denver (Colo.) Homeworkshop Club. This particular display was held in the Y. M. C. A., but the club also gave a store-window exhibit for two weeks

IT COSTS YOU NOTHING TO BELONG TO THE GUILD



NEAT TAP-AND-DIE CASE

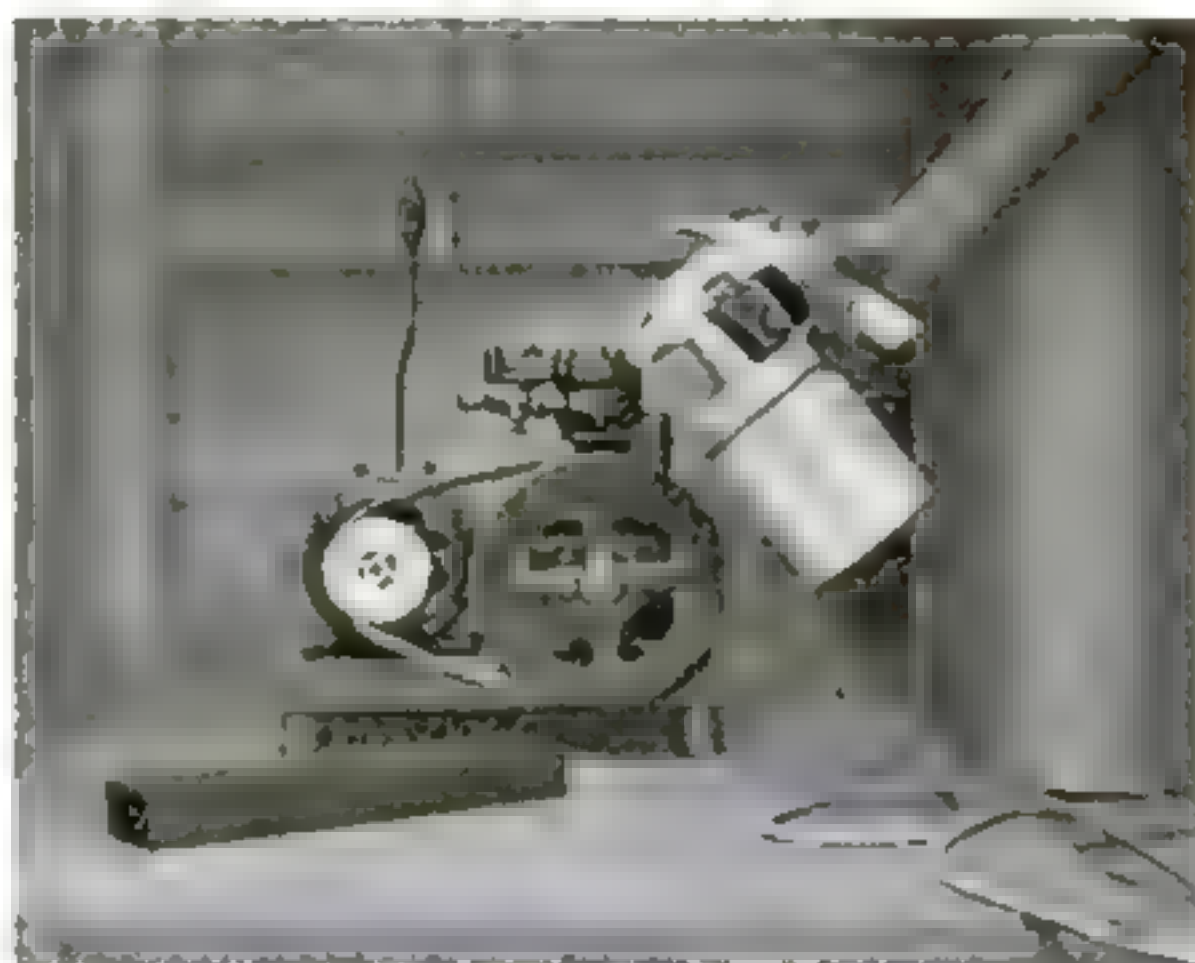
To PROTECT small taps and dies, a case can be made from a so-called "flat fifty" cigarette tin and a piece of plywood with jig-sawed recesses for the tools.—C. F.

OLD REFRIGERATOR UNIT SUPPLIES AIR

EVERY home workshop enthusiast can find many uses for a ready supply of compressed air. From parts that are probably available in your local power company's junk pile, a serviceable compressor and storage tank can be made. I purchased an old refrigerator unit for five dollars and an old pump tank and control from a junk yard for three dollars. The pressure gauge and pressure relief valve are not essential, but make a better job.

Although the compressor shown is a twin, a single will do. Take the compressor apart, tighten the bearings if they are loose, and reassemble. The valves on most domestic compressors are located on a plate in the head. Polish the seats of the discharge and suction valves by rubbing the valve plate on a piece of 400 emery paper lying on a flat surface. Put in new valve reeds and gaskets, and reassemble the head. Light motor oil should be used in the compressor.

If the bearings in the motor are bad, press in new ones. New brushes often help a motor and, if you have access to a lathe, the commutator should be turned down and polished. If you true up the commutator, cut out about 1/16 in. of the



This compressor is from an old refrigerator and cost five dollars, and the tank was bought from a junk yard for three

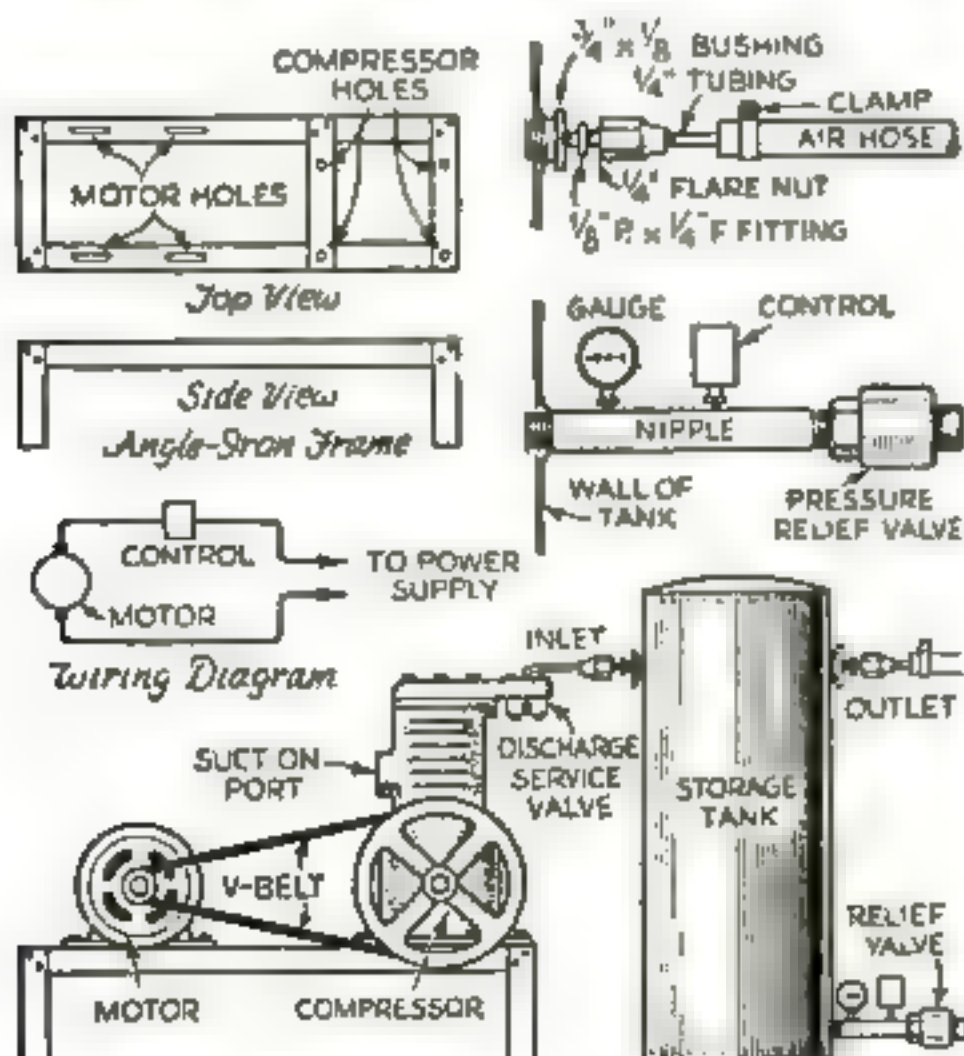
dollars. The motor and compressor shown in the photograph are mounted on a board with pipe legs, but a frame made out of angle iron and strap iron is better. Slot the holes for the motor bolts so the belt may be tightened.

Most tanks have at least three holes; the one I used had three 3/4-in. holes. With a bushing I reduced the size of the inlet and outlet so that a 1/8-in. pipe by 1/4-in. flare fitting could be screwed into them. On the third hole I used a 3/4 by 6-in. nipple, and tapped two holes into it to take 1/8-in. pipe threads. These holes were for the pressure gauge and the pressure control. The relief valve was screwed on the end of the nipple. Use litharge and glycerine on all joints.

Connect the discharge port of the compressor to the air inlet of the tank by a 1/4-in. piece of copper tubing. The suction port of the compressor is left open.

Start the motor to find at what pressure the control shuts off the engine. On most controls, adjustments is made by turning a nut which varies the tension of a spring. Adjust the control to shut off at a convenient pressure, which in my case was 50 lb. The relief valve should be set to blow off at a pressure less than the rated working pressure of the tank.

No dimensions have been given because they can be arranged to suit the equipment at hand. After a little experimenting, you will be able to adjust the control to suit your requirements.—J. L. PEACOCK, JR.



How the entire outfit is set up; details of the fittings and stand; and a wiring diagram

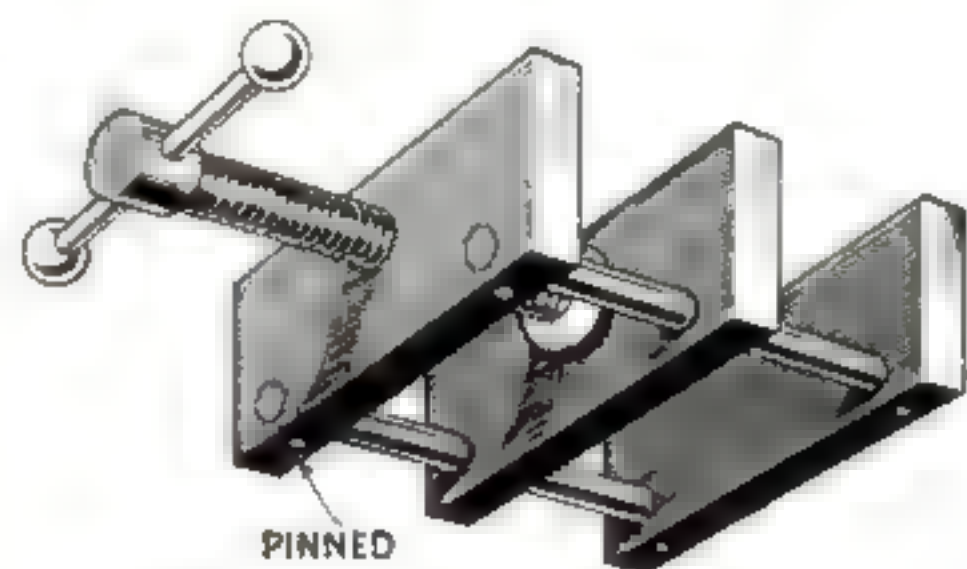
RAISED V-BLOCK FOR WELDING AWKWARD WORK

MOST welders use V-blocks which they have made themselves from ordinary angle stock with the corners welded together. If short lengths of tubing are welded between the angles as shown in the accompanying illustration, it will make them more useful, particularly in working on objects having projections of any sort at one or both ends. A good plan is to use one long V as a base and fasten two short ones



A gap-type V-block made from one long angle, four short lengths of tubing, and two short angles. It holds a large variety of work

to it, with a space left between the small angles. This makes a doubly convenient fixture.—J. C. COYLE.

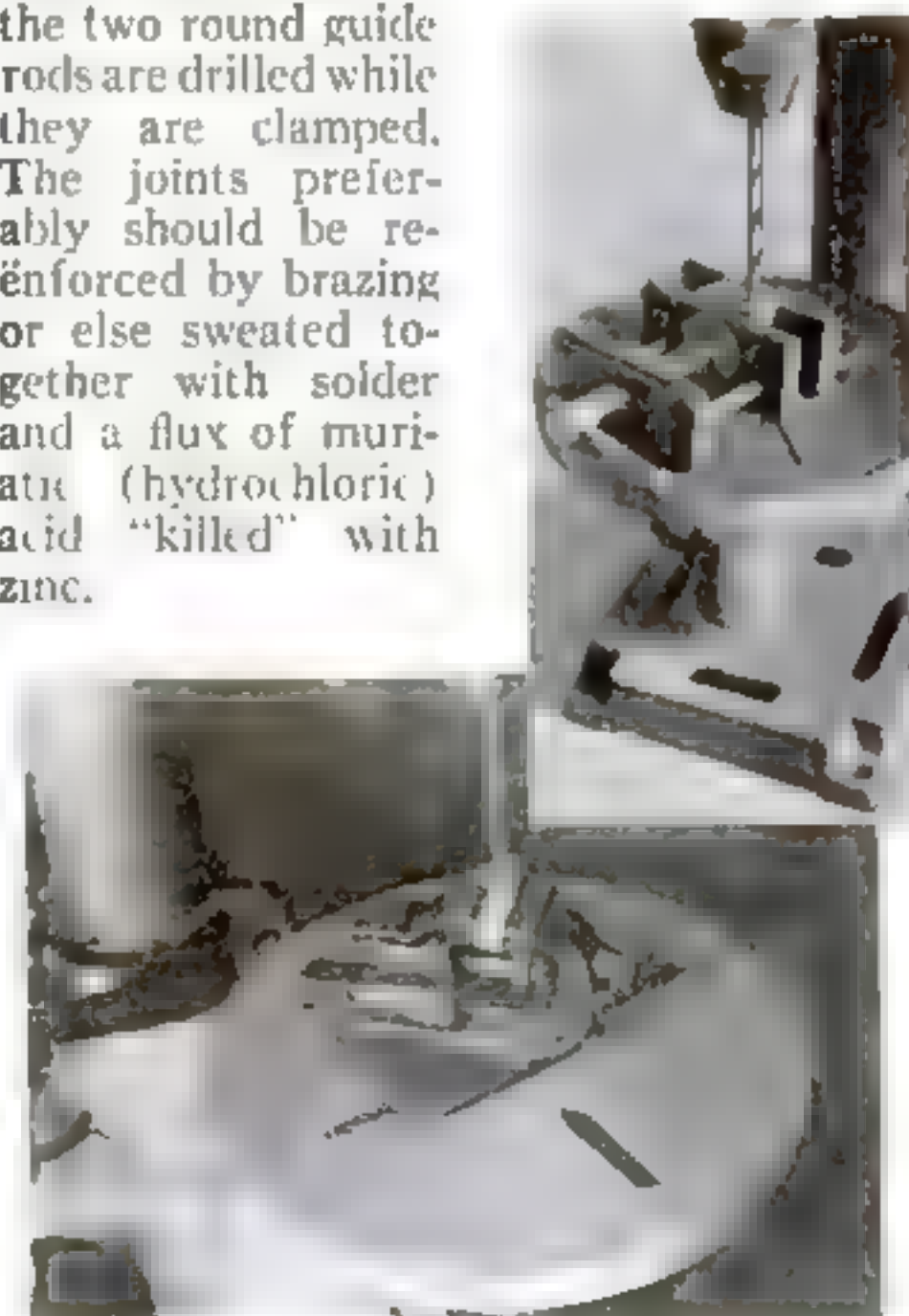


TWO INEXPENSIVE VISES FOR THE DRILL PRESS

ATTEMPTS to hold small work on a drill-press table by hand often results in bruised fingers. A vise should be used, and in the absence of a suitable commercial vise, there are two ways in which one can easily be made.

The first method is to cut the C-clamp off the bottom of a cheap bench vise and fasten the vise proper to a flat base plate with flathead machine screws.

A more versatile vise may be made by taking the lead screw from a machinist's C-clamp or using any suitable bolt. Three rectangular pieces of steel of convenient size are firmly clamped together, and the ends filed flat and square so that the vise can be used on its side. To assure alignment, the holes for the two round guide rods are drilled while they are clamped. The joints preferably should be re-enforced by brazing or else sweated together with solder and a flux of muriatic (hydrochloric) acid "killed" with zinc.



A drill-press vise made from a cheap bench vise, and, above, an even more useful design

HOMEMADE TOOL Shapes Metal Tubing

IN COUNTLESS
DECORATIVE FORMS

WORKING in brass and copper is a craft that opens up a long lane of possibilities to the amateur. It is therefore unfortunate that most books on the subject give scant aid to the serious-minded worker. For example, nothing has been published, so far as I know, about the process to be described for making ornamental parts from ordinary tubing, yet this is a matter of everyday knowledge among professional silversmiths.

Suppose you wish to make a ferrule for a lamp standard, or anything of that sort. First prepare a tool from a piece of $\frac{1}{2}$ -in. drill rod, 8 or 10 in. long. About $\frac{1}{2}$ in. from the end, cut a notch slightly more than halfway through the steel. The bottom of the notch is rounded out smoothly, the back is smoothed off to make an easy curve, and the end is rounded off more or less spherically.

If you will clamp this tool solidly in the vise as shown in the upper illustration and slip a short length of annealed brass or copper tubing, say 2 or 3 in. long, over it, you will be ready to start. A planishing hammer and a raising hammer are desirable although not essential for your initial experiments. As soon as you become genuinely interested in metalcraft, these hammers will be indispensable, so you may as well get them now. They are not expensive.

With the tubing in place, take the sharp end of the raising hammer, or a hammer having a similarly shaped head (a riveting hammer, for example) and start hammering the metal down into the notch of the tool, turning the work as you hammer. This will result in a constriction or neck, which can be driven down almost as

By J. S.
HAGANS



The tool is gripped in a vise and used as an anvil. At left are a variety of sockets and ferrules. The tall example is in three parts

deeply as desired, provided room is still left for removing the tool.

A simple socket, frequently needed for a variety of purposes, is made by hammering the end of the tubing up against the backward slope of the notch. Tilt the work and move it back and forth and up and down as the flange is expanded, as shown in the diagram marked A. The direction for hammering is indicated by the arrows.

If a ball or bead is desired at any point along the work, another neck is driven in as at B, and the metal between is then worked out on the end of the tool, the tubing being reversed as required. At C is shown a variation used for forming a ball or oval over the end of the tool, and D shows another application.

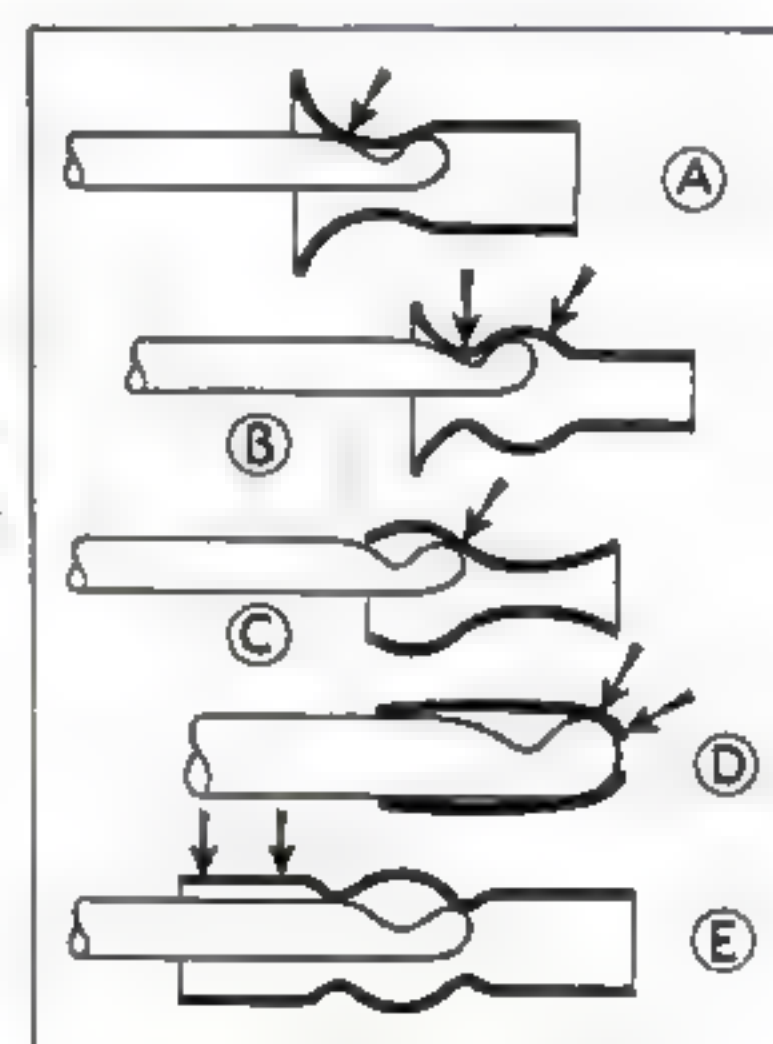
When it is desired to reduce the

diameter of the tubing in order to emphasize a ball or bead, the parts beyond the necks are hammered down, as at E, on the cylindrical part of the tool, the work being reversed as required. It is possible to hammer such sections down to the level of the neck, though it is likely that the work may have to be annealed and the operation repeated more than once before the metal has been compressed into its smaller diameter.

The method closely resembles turning in wood and is really quite simple, but it does require a certain amount of practice. The most im- *(Continued on page 95)*



Only two ordinary metal-working hammers and a short drill rod notched near one end are required for making many artistic projects of copper and brass



Diagrams showing how metal is formed by hammering the tubing against the notch. At left is a lamp, the central ferrule of which was made in two parts and soldered



Alice opens out like a telescope and gives her audience another stunt to wonder about



Mozart at the piano. His hands are of sheet lead, covered with two layers of muslin

TRICK *Marionettes* WILL ENLIVEN YOUR PUPPET SHOWS

By
*Florence
Fetherston
Drake*

MARIONETTES that will perform all sorts of amazing tricks can be made without difficulty, once the secret of their construction is understood. Ball tossing, for instance, is a simple trick. Then there is the skeleton that disjoints his limbs and throws his head into the air, and the dwarf who grows into a giant. Various adventures of Alice in Wonderland also can be portrayed.

For ball tossing, drill a hole through a wooden ball and run both strings through it, passing the ends through the palms of the marionette's hands and knotting the ends, as in Fig. 1 of the drawings. Tie the other ends to an extra 12-in. stick. By tilting the ends of the stick alternately, the ball will fly up and down. There is less friction if the string is waxed and the hole in the ball is burned through with a red-hot wire, instead of being drilled.

Two balls may be used—one on each hand, or on one hand and the opposite foot. A puppet lying on the floor, with strings attached to each toe and passing through a ball, can kick the ball up in the air from foot to foot, as shown in Fig. 2. Instead of a plain ball, a 10-in. bar with a ball at each end can be used, as shown in Fig. 3. The strings pass through the bar near the ends and through the puppet's hands, with a small knot between each hand and the bar. When the puppet car-

ries the bar, the outside strings are pulled tight, while either hand can be lifted from the ball by pulling the inside strings.

A skeleton, the bones of which fall apart at will, requires more strings than usual (Fig. 4). The No. 1 strings support the body and are at-

tached to the shoulders, then passed through small screw eyes on each side of the skull to prevent the head from turning; No. 2 strings control the legs; No. 3 strings control the hands; No. 4 strings are fixed to the top of the arms and passed through holes in the collar bone; and No. 5 strings are attached to the top of the legs and passed through small holes at the hips. The No. 6 string is fixed to the top of the skull by means of a small screw eye, and passes through another small screw eye in the controller A. Then it is tied to a ring, button, or small piece of wood that may be easily grasped.

Figure 5 shows a side view of the skull. The jaw is separate from the rest of the skull and is held loosely in place by a small screw at each side. A vertical hole halfway through the skull allows it to rest on top of the spinal column. A suitable hole is made with a red-hot wire just large enough for the string to pass through, the string being fastened to the top of the spine with a small screw eye.

By shaking the skull slightly, the jaw is made to move as though chattering. The

DWARF

AT CHANGES INTO

T,

skeleton can be danced around the stage, suddenly stopped, and the head lifted out of sight into the flies by pulling No. 6 string by the ring. If the controller *B*, to which the No. 4 and 5 strings are attached, is lowered, the arms and legs fall away from the body. They can be made to do shivering, shaking movements in mid-air as far away from the body as the length of the strings permit.

When these evolutions are finished, the limbs join with the body again, the skull falls down on the spine, and the figure dances off. Make the marionette dance over the stage in a low light against a dark background. By alternately raising the ends of *B*, the skeleton waves its arms and legs about. Pull up the center string that supports the head so it will float and then drop it back into place.

The ribs, feet, hands, arms, and legs are made of firm cardboard. The jaw can also be made of cardboard, and the rest of the head and figure carved out of wood or cork. If the entire head is made of wood, the jaw will click as it shuts. The ribs can be made of covered wire if that seems easier to do. Several coats of dead white paint are needed, and luminous or phosphorescent paint may be used, if desired, to give a still more uncanny effect. It is unnecessary to have this figure anatomically correct; instead, strive to make an effective, entertaining puppet.

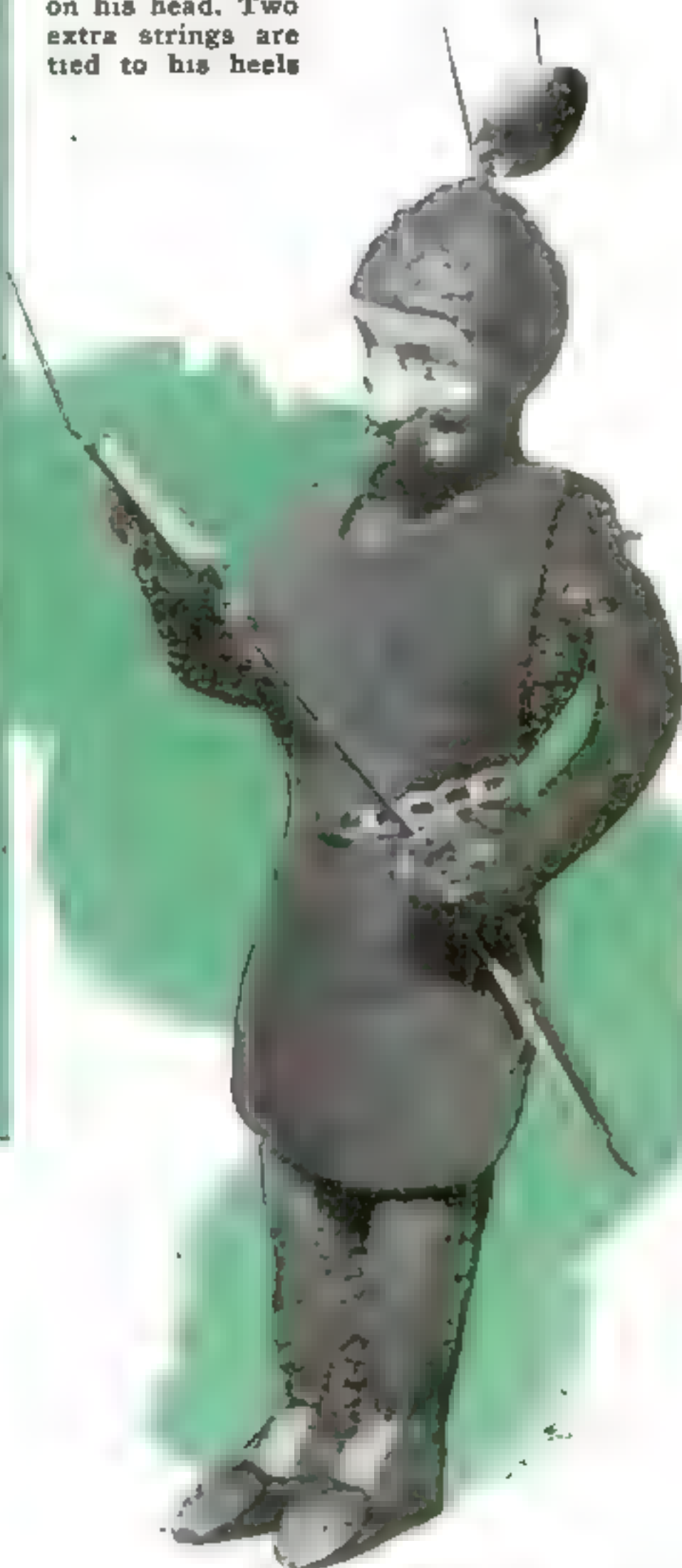
An amusing figure called the "giant dwarf" is shown in Fig. 6. There is no body inside the costume except the shoulders. The strings attached to controller *A* pass through screw eyes in the shoulders, are drawn through the costume, and tied to screw eyes in the feet. From controller *B*, strings are attached to the head behind the ears and a second set to the hands. The feet are cut from wood and at each heel a lead dress weight is held in place by a screw eye. These are covered with two disks of felt, and the trousers are then sewed to the felt to hold them in place.

By raising the leg control *A*, the figure will fold up and become a dwarf; by lowering the stick, it becomes a giant. An effective use of this idea is as a jack-in-the-box. A box, large enough to hold the figure when dwarfed and gayly painted, has a string attached to the front of the lid. Pulling this string lifts the lid, and out jumps the dwarf, who can be made to hop about in an engaging way and suddenly loom up as big and important as a giant. The head of the clown (Fig. 7) is hollow, being made like a mask. It reaches only a bit below the mouth so as to leave a large opening. This permits free movement over the point of the throat, where there is a screw eye through which a wire passes. It is looped back of each ear as shown.

Whenever a puppet's hand must be drawn to any special place, an extra string is usually passed through the hand and through a hook or ring at the desired spot. To place hands on hips, akimbo, sew a small metal ring to each hip (Fig. 8).



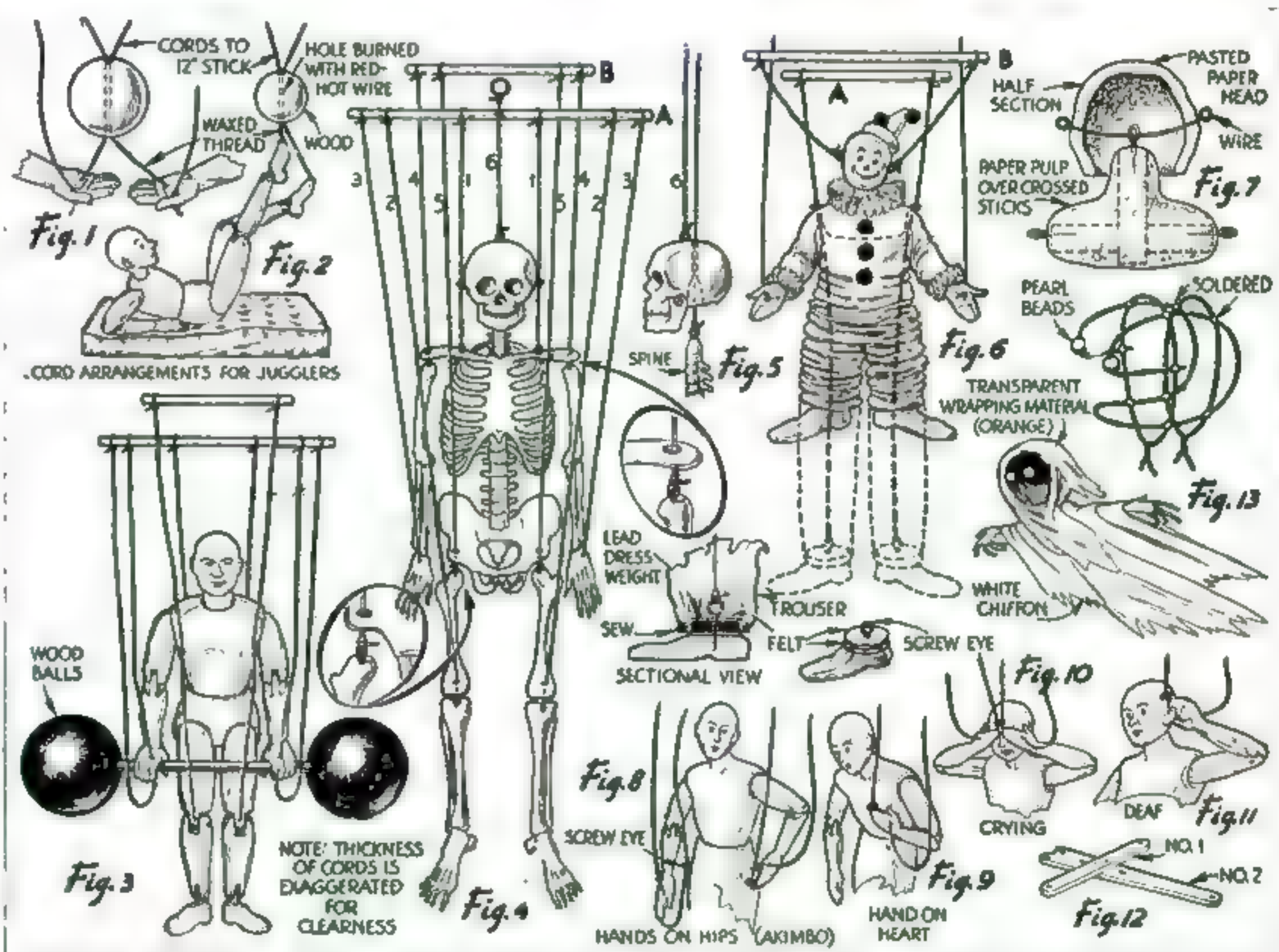
Another "Alice in Wonderland" trick. Father William shows his son how young he is by standing on his head. Two extra strings are tied to his heels



A knight draws his sword from its scabbard. This is done with a string through his hand

Tie one extra hand string to the tips of each hand, not through the palms, run it through each ring, and draw it up above the controller. Let the hands hang straight down at the sides and tie the strings together. Put a thumb tack in the center of the main rod and slip the string over this when not in use. When this loop is raised, the hands will fly to the hips. When the regular hand strings are raised, they will fly out again.

On the same (Continued on page 83)



Sketches showing how to construct a number of trick marionettes. The strings have been drawn somewhat thicker and shorter than they actually are in order that their arrangement and manipulation would be clearer

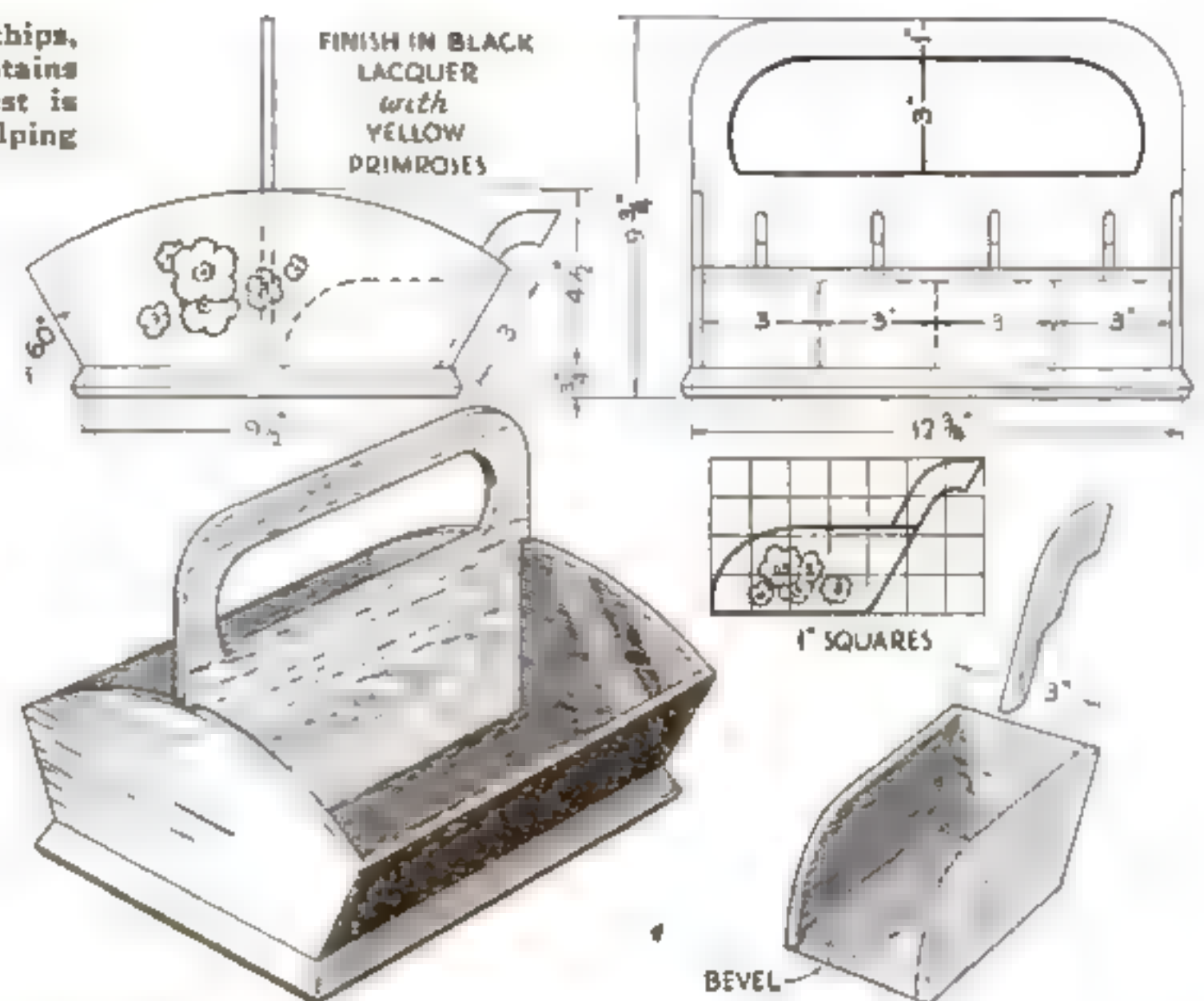
NEW AND
ATTRACTIVE

Woodworking

POPCORN SERVER HOLDS EIGHT SMALL SCOOPS



Designed for serving popcorn, potato chips, and similar appetizers, this bin contains eight individual scoops. Each guest is therefore able to take a good-sized helping



THIS bin with its eight scoops provides a unique and appetizing way to serve popcorn, potato chips, and similar tidbits. The eight scoops fit neatly in the bottom of the tray, which is then filled with corn or chips, and the guest merely lifts out a scoop already filled.

The project is scroll-sawed from $\frac{1}{4}$ -in.

plywood, except the base and the scoop handles, which are thicker material. Cut out the various pieces and give them a thorough sanding on both sides. This is important because the beauty of the completed article lies largely in its glossy lacquer finish. Brads and casein glue are used at all joints. It is a good

idea to apply one or two undercoats before assembling. Rub with fine sandpaper or steel wool before giving the final coat of lacquer.

A black background with bright yellow primroses makes an effective combination, or cream with blue flowers.—H. S.

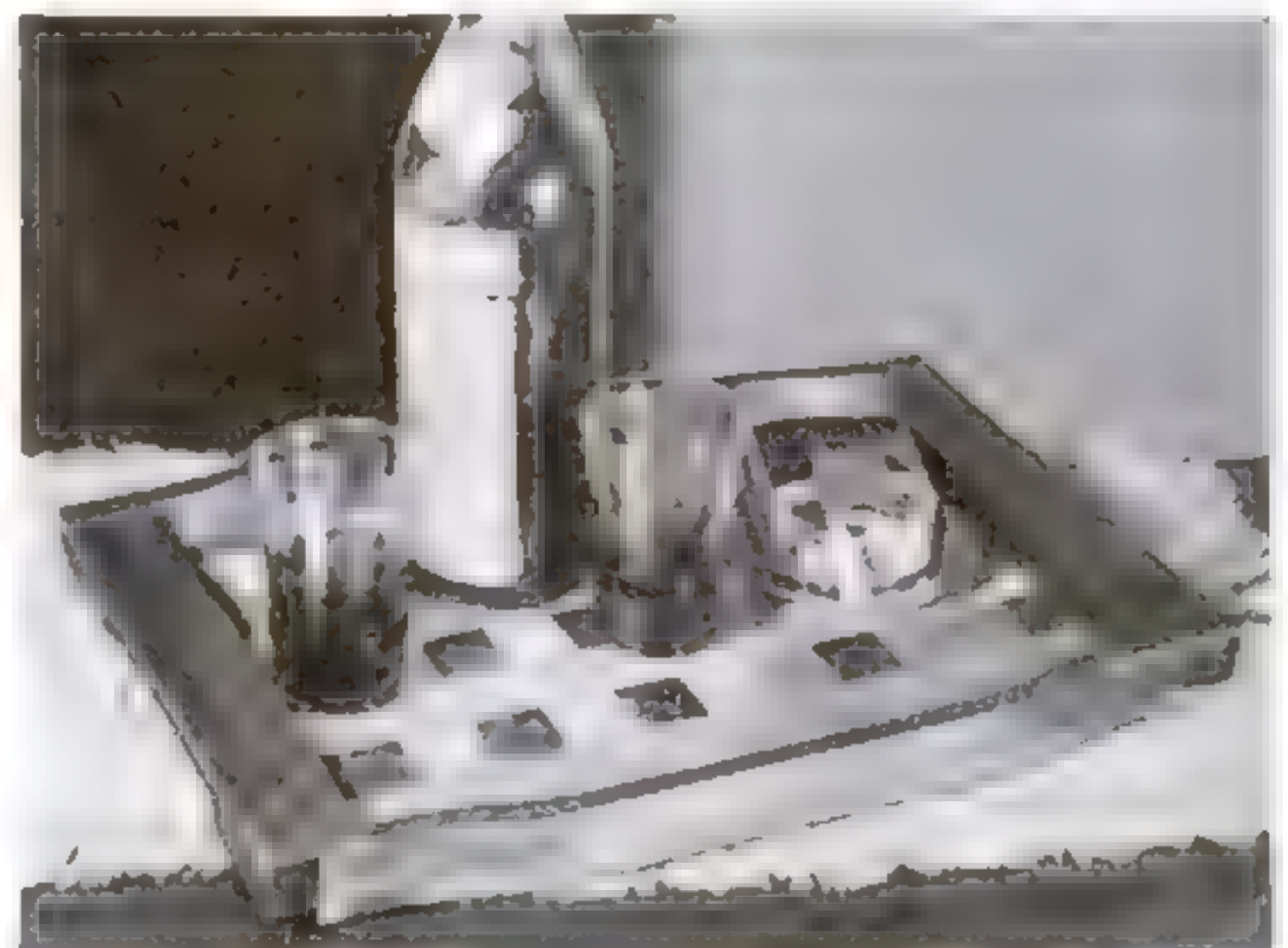
WOODEN SERVING TRAY BUILT IN A MOSAIC PATTERN

SQUARES of attractively grained woods, glued together, give a mosaic appearance to this serving tray.

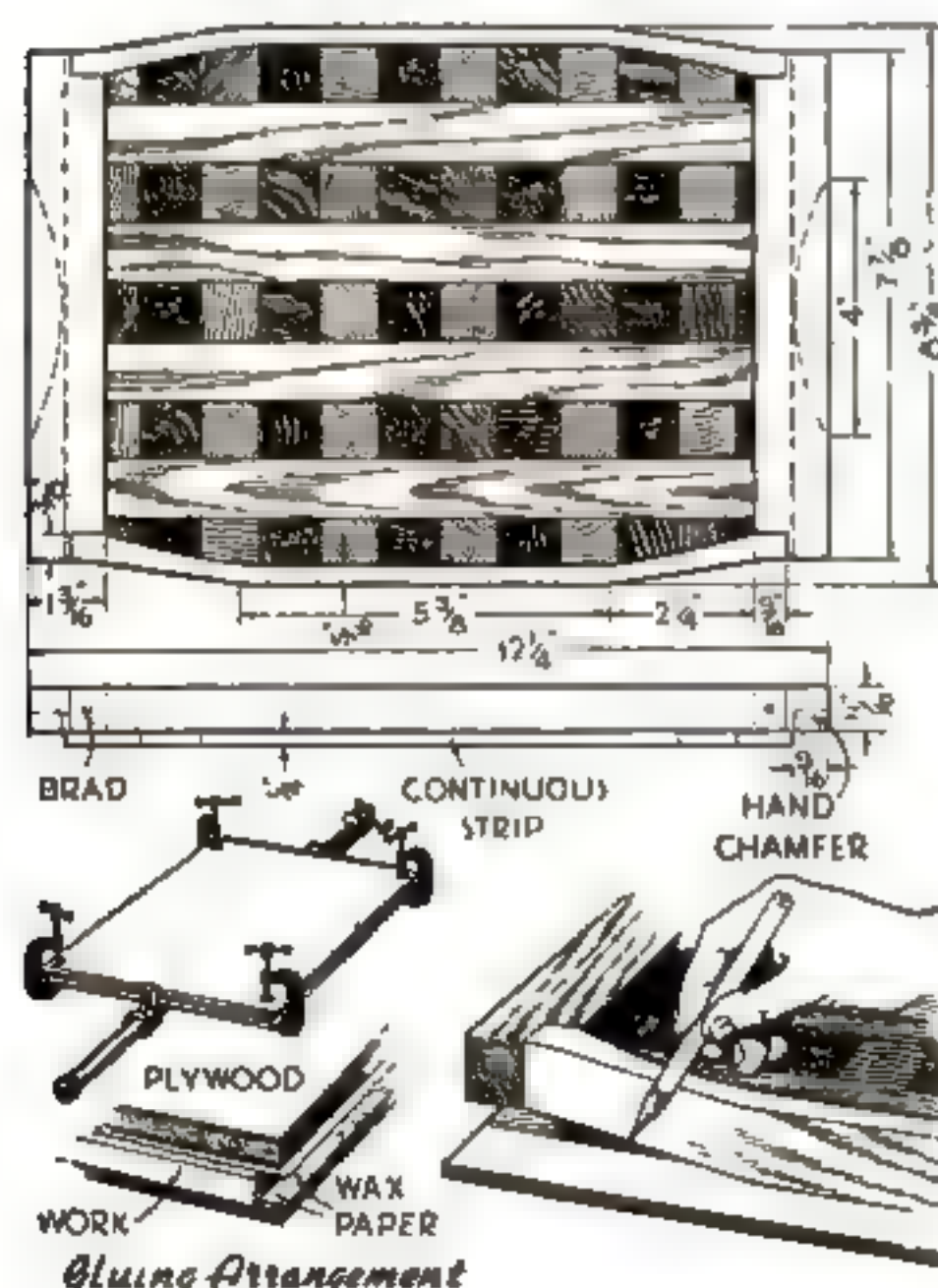
Use for the squares such woods as cedar, walnut, maple, or apple. Cut the squares from stock $15/16$ -in. square, and sand

carefully to $\frac{1}{4}$ -in. thickness. Sixty squares are needed for the tray. Alternate the lines of squares with strips of maple, and place strips along two sides as boundaries to be used in clamping. These side strips are of walnut, to match the sides and ends of the tray.

Arrange the squares and strips on a piece of plywood covered with wax paper. The plywood should be of a size to allow the boundary strips to project a short distance for clamping. Use a good grade of glue; the writer's preference is a slow-setting hot glue. Work it well into the gluing surfaces. With another piece of plywood, also covered with wax paper, clamp the work as illustrated so that it will not buckle when pressure is applied with the bar clamp. Another bar clamp at right angles to the first and on the opposite side of the set-up insures perfect joints in the gluing. When the glue has set for its full drying time, remove the clamps and sand the work smooth on a



Squares and strips of various woods contribute to the mosaic appearance



Top and edge views of the tray, how the bottom is glued up, and method of marking shape

flat surface in order to avoid strains.

While waiting for the glue to dry, make the sides and ends of solid walnut. Join the ends and sides with glue and brads. Lay this part on the mosaic bottom in order to trace the outside edge for sawing. Complete the sawing, and glue the bottom to the sides and ends of the tray. Two coats of varnish and an application of wax complete the tray. Since a poor finish can ruin the appearance of any piece, see that the varnish is well rubbed down to a perfectly smooth surface. The tray will then be something to win the acclaim of your guests.—D. W. PRINCE.

Novelties for Gifts

Book Ends Tell Story of a Dog Chasing a Woodchuck . . . Modern Lamp Turned from Old Bowling Pin . . . Mosaic Serving Tray . . . Popcorn Bin

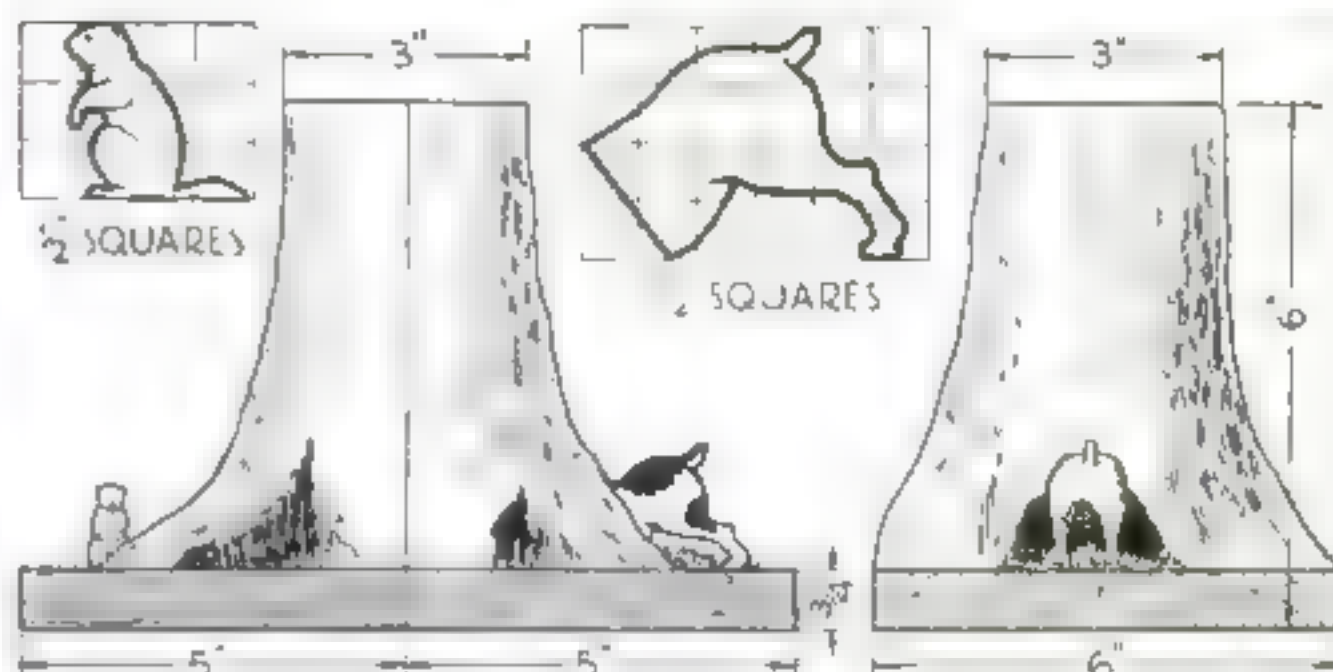
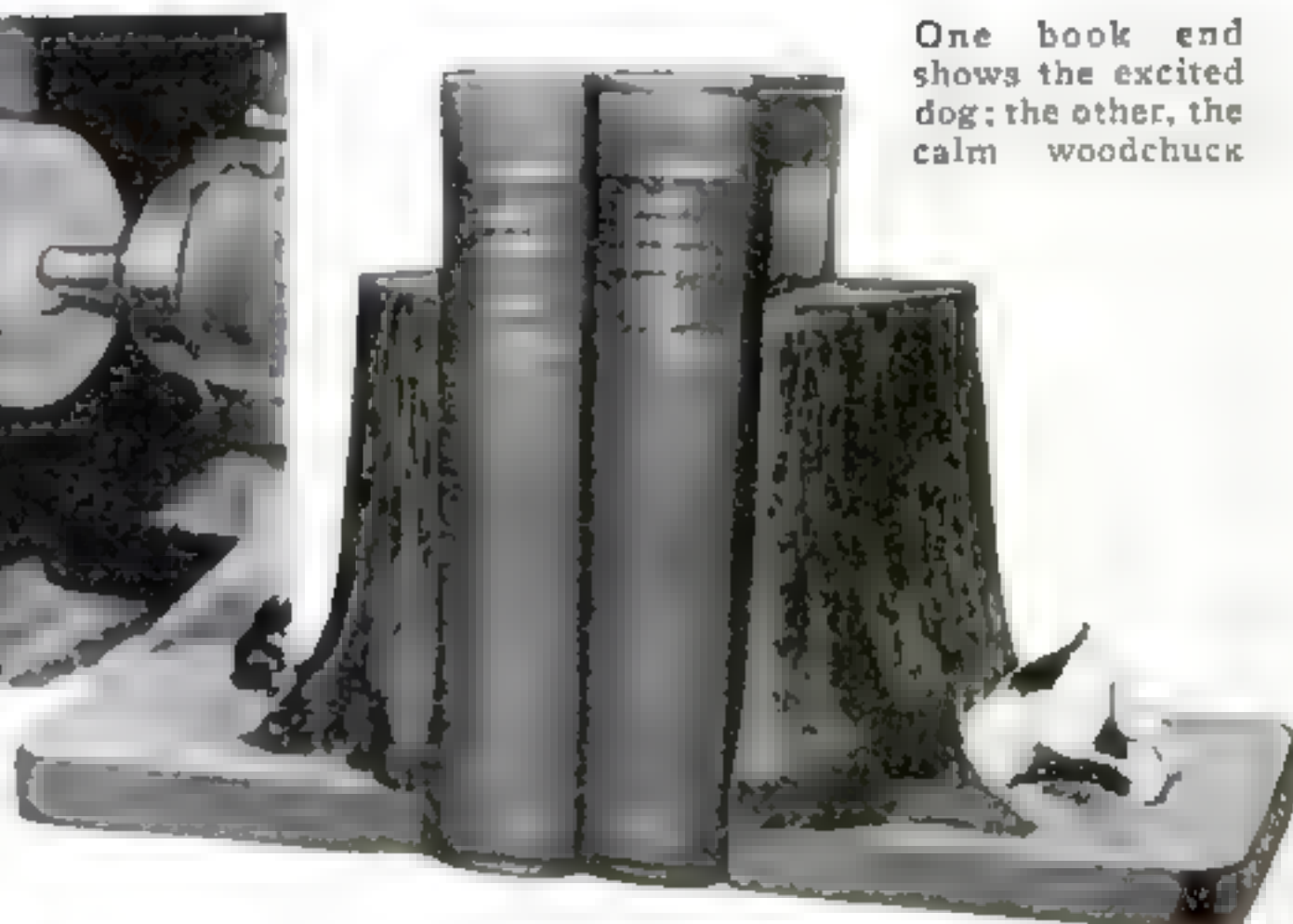
"YIP, yip, he's in there," yelps Jiggers as he digs furiously away under the roots of the old stump. In the meantime, Chukky woodchuck is sitting out in the open on the other side and saying to himself, "I wish that fool pup would quit stirring up a dust in my house."

You can reproduce this old, familiar struggle in an amusing way on a pair of novelty book ends like those illustrated. To make the stump, you will need a piece of soft pine 6 by 6 by 6 in., or a similar block glued up from thinner pieces. Put the block in the lathe and turn the stump to shape, with a flare at the bottom for the roots. Then, using the scroll saw, cut the recesses between the roots. Saw the stump in halves and mount each on a base of 1-in. lumber.

After the ends have been assembled with screws, the woodchuck hole is cut under the edge of the stump with a gouge. A pile of wood composition or sawdust and glue is placed around each opening to resemble the dirt. If you wish to extend the tree roots out farther, they can be formed of the same material.

The animals are cut from small pieces of soft pine. The final finishing can be done with a sander spindle made from a dowel and rotated in the drill press or, better still, in a flexible shaft. The body of the dog is pushed down into the hole so that only his hind legs and a small part of the back show outside.

For finishing, roughen the stump to resemble bark. This can be done with a wood rasp turned crossways and rubbed up and down the stump. After it has been

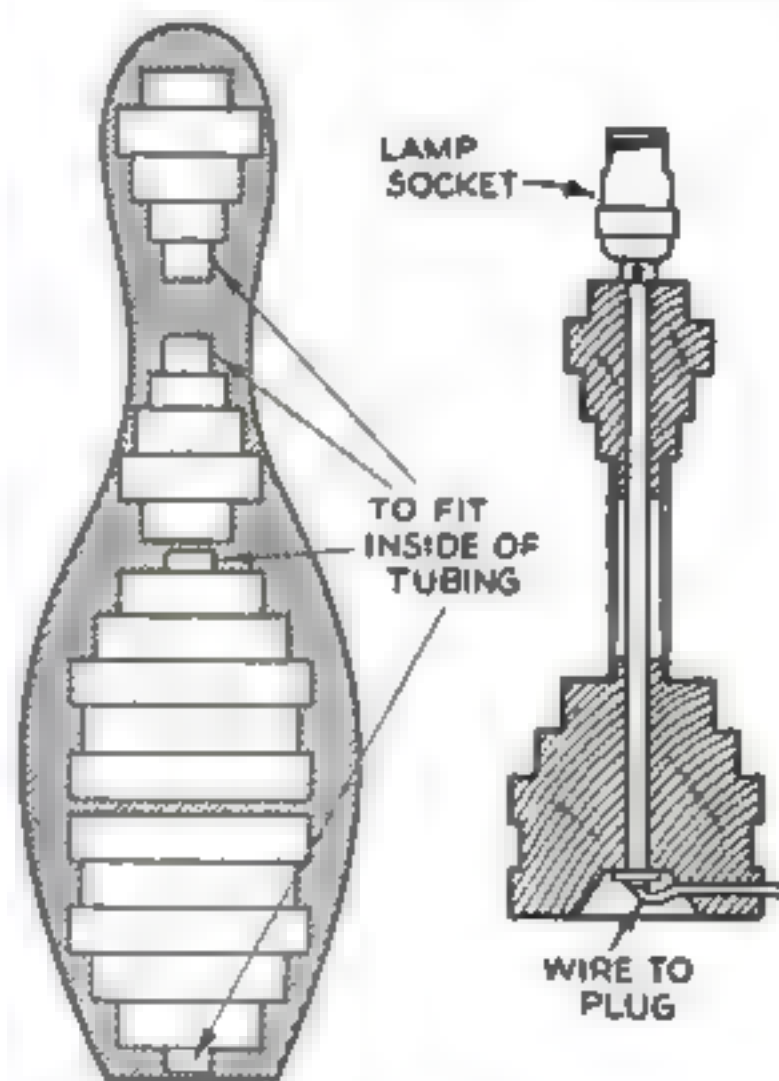


Two operations are shown in the photos—how the stump is turned to shape and how the recesses between the roots are cut on the scroll saw. Suitable dimensions are suggested in the drawings

brushed down with a steel wire brush to remove loose wood splinters, it should be stained dark and then brushed over lightly with dark gray paint to give it a gray color on the high lights. The dog is given two coats of white enamel and then the spots of black are painted on. Chukky is

given a coat of brown stain, and his underside brushed with white paint. He is fastened by a small nail or pin driven down through the body into the base-board. The base around the tree is either stained brown to represent earth or painted green for grass.—D. C. MARSHALL.

OLD BOWLING PIN MADE INTO LAMP



The photograph at the left shows one finished lamp and a battered old bowling pin. The drawings illustrate how to make two lamps from a single pin

YOUR local bowling alley is a source of supply for high-grade maple in the form of discarded bowling pins. These can usually be had for the asking or at a nominal price. They can then be turned into various articles on the lathe, such as the lamp illustrated at the left. The bottom edges of bowling pins become chipped from the battering they undergo, so they are squared up two or three times to prolong their usefulness and then are thrown into the wood bin for firewood.

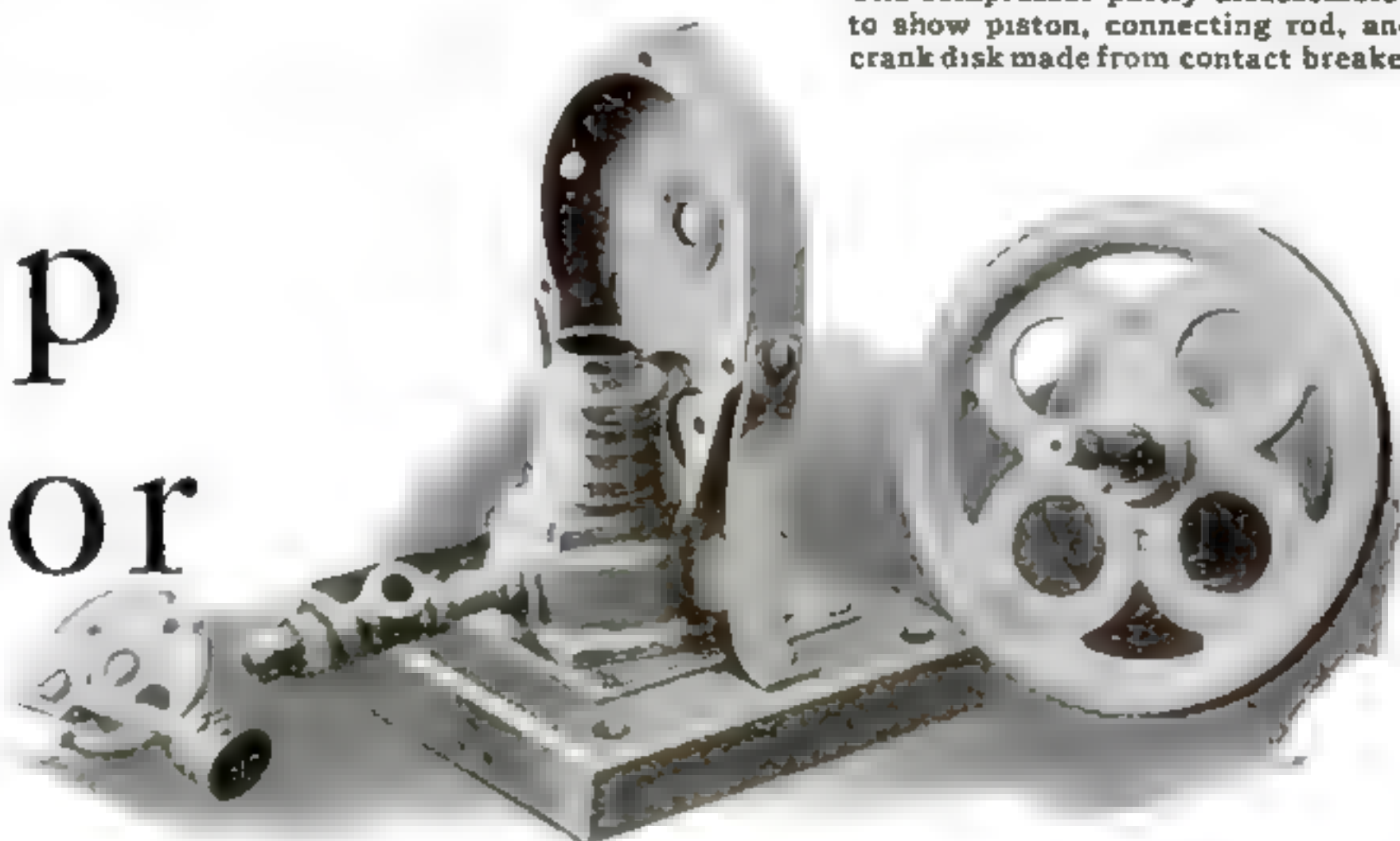
Two lamps can be made from one pin as shown in the drawings. The shafts in this instance were made of nickel-plated plumbing pipe, but aluminum, chrome-plated tubing, brass, or wood may be used. The dimensions will vary to some extent with the condition of the pin, because some are battered more than others.

A length of $\frac{1}{8}$ -in. pipe (it is, of course, larger than that, but this is the standard pipe-size designation) is threaded at both ends and used to hold the parts together. The wooden parts are shellacked in the lathe, and the whole lamp lacquered after being assembled. Stains, antiquing, and other finishes may be used, if desired, to match furniture.—B. G. S.

Small Workshop Compressor

By H. L. SWAN

The compressor partly disassembled to show piston, connecting rod, and crank disk made from contact breaker



MADE entirely out of scrap materials, the small compressor illustrated will raise a pressure of 25 lb. per sq. in. in a 6-cu. ft. tank in 25 minutes, which is ample for the average small gas torch. The consumption of line-shaft power is very small, an important consideration in many small shops.

Construction of the compressor is clearly shown in the photograph and large drawing below. Simplicity is the keynote of its construction throughout. The magneto which supplied most of the larger parts was purchased for fifty cents.

The method of procedure will be governed to some extent by the type of magneto available. Assuming the gear housing to be of cast iron and the end bearings to be of brass, it is a simple matter to saw and file out the gear housing to fit on the end bearing housing as shown. The two are fastened by a machine screw after being sweated together with soft solder. To do this successfully, the cast iron must be thoroughly cleaned and well tinned. The axis of the shaft hole in the gear housing must be kept parallel with the finished face of the brass base. Do not fasten these

parts together permanently at this stage.

Chuck the base in the lathe and bore for the cylinder. The size depends upon the bushing used for a cylinder, but the drawing indicates the proportionate allowances to be made for shoulders and the like.

The next step is to turn, bore, and lap the cylinder to an inside diameter of $\frac{7}{8}$ in., with other dimensions to suit the actual bushing available.

The cylinder bottom is soldered into place after fitting the simple ball valve. Make the valve seat very narrow, use a new ball, and tap the ball lightly on its seat before assembling to insure a tight valve.

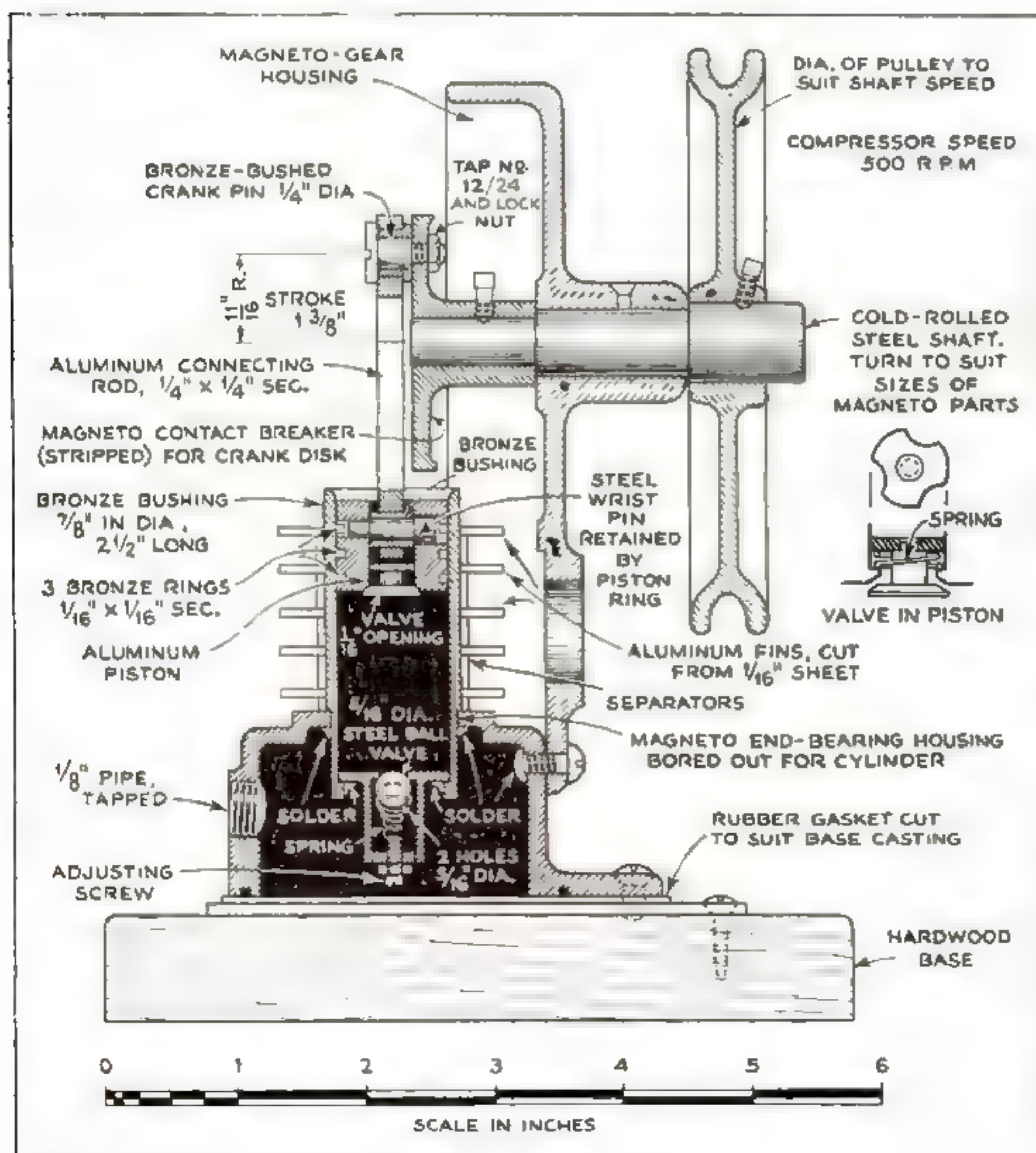
Mount the cylinder in the base and solder as shown. Care must be taken to see that the bore is at right angles to the finished face of the base. Note the aluminum cooling fins, which can be turned in the form of washers and threaded on the cylinder before mounting, with aluminum separators between them.

The piston is built up from $\frac{1}{8}$ in. sheet aluminum cut into disks $\frac{7}{8}$ in. in diameter and riveted together. The rivets must be so placed that they will not interfere with the ring grooves or the piston-pin hole. The inlet valve in the base of the piston is retained with two turns of very light steel spring sprung into a groove just above the valve seat. The ring grooves are turned $\frac{1}{16}$ in. wide and $\frac{1}{16}$ in. plus .002 in. deep. The rings are $\frac{7}{8}$ in. in diameter and $\frac{1}{16}$ in. thick, split at an angle of 45 deg. and sprung over the body into place, care being taken not to deform them.

The connecting rod is also built up out of the $\frac{1}{8}$ -in. aluminum sheet, two pieces being riveted together through the center section. The ends are left square in section as shown in the photograph and are fitted with bronze bushings for suitable pins, as indicated in the drawing.

Care is necessary to insure that all joints are air-tight, because with such a small displacement a very small leak will seriously cut down the efficiency of the compressor. The best running speed is about 500 r.p.m.

The lightness of the oscillating parts and the comparatively heavy driving pulley, acting as a flywheel, reduce vibration to a minimum, but the braces shown are necessary to give general lateral stiffness. They are bent out of $\frac{3}{8}$ -in. flat steel $\frac{1}{8}$ in. thick, and fitted into place.



Model of a typical oil tanker. It is 14 in. long, but looks larger. The base is 4 by 18 1/4 in.



SIMPLIFIED
PLANS FOR A

Tanker Model

... Spick-and-span Symbol of the Age of Oil

THE widespread use of oil as a fuel has given the oil tanker a position of great importance in ocean commerce. There is hardly a port in the world not visited by these remarkable ships, which have been described as "perpetual-motion machines of the sea" (P.S.M., July '36, p. 30). The spick-and-span appearance of each tanker, as it proudly flies the house flag of some large oil company, is as characteristic as the unique location of

its funnel. We have therefore chosen a typical oil tanker as the new project of the Popular Science Model-of-the-Month Club.

Those who built the freighter described in a previous issue (P.S.M., Oct. '35, p. 57) will see at once that the new model is constructed along the same lines and that many of the details are similar. The plans are not a direct copy of any one particular tanker, but represent the average design. The scale is approximately 1 in. equals 30 ft., and the model is 14 in. long.

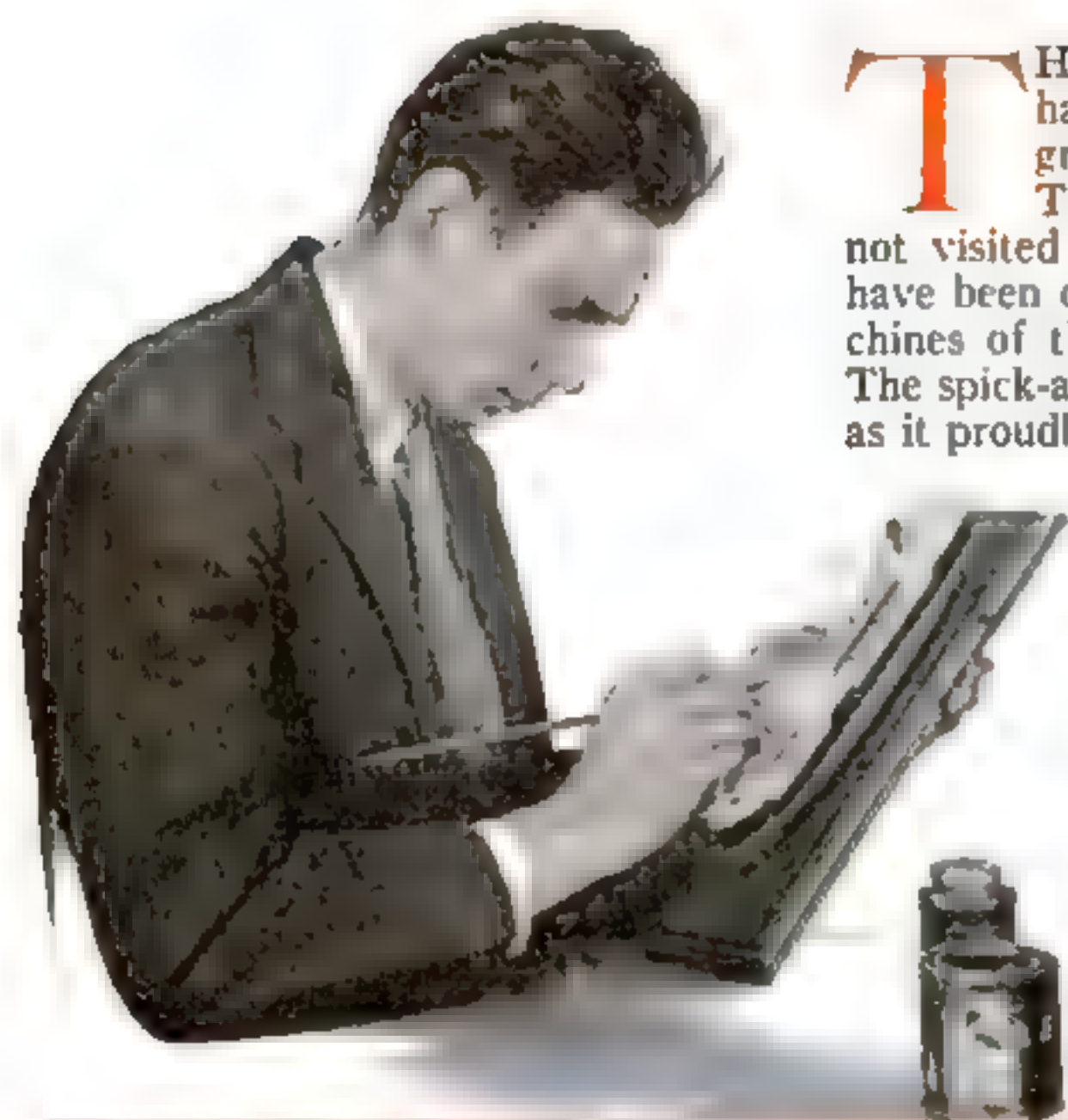
White pine or basswood is best suited for a model of this size, though balsa may be used, and the remaining materials are easily obtained. A complete list is given near the end of this article.

Begin with the construction of the hull. To facilitate the shaping of the counter and sternpost, saw a slot 2 3/4 in. long down the center of piece A, as shown in the drawings. Lightly nail A to B, or use two dowels without glue, so the parts can be separated later. Glue C, D, and E to B, and F to E, and then proceed with the shaping. The cross-section diagrams are included in the plans for general information, but it is not necessary in a model of this size to make templates for testing; your eye will be a sufficiently accurate guide.

Round out the hull at the stern to the approximate shape of the dotted line shown in the side elevation. Insert the fiber rudder and sternpost into the slot previously cut into A, and using wood filler or a plastic type of wood composition, shape the hull where the fiber piece joins A and B. Make the propeller shaft by attaching two short pieces of split dowel or split reed to the fiber piece, and attach the screw to the hub. Now separate A and B, and paint A, and all parts that are attached to it, red.

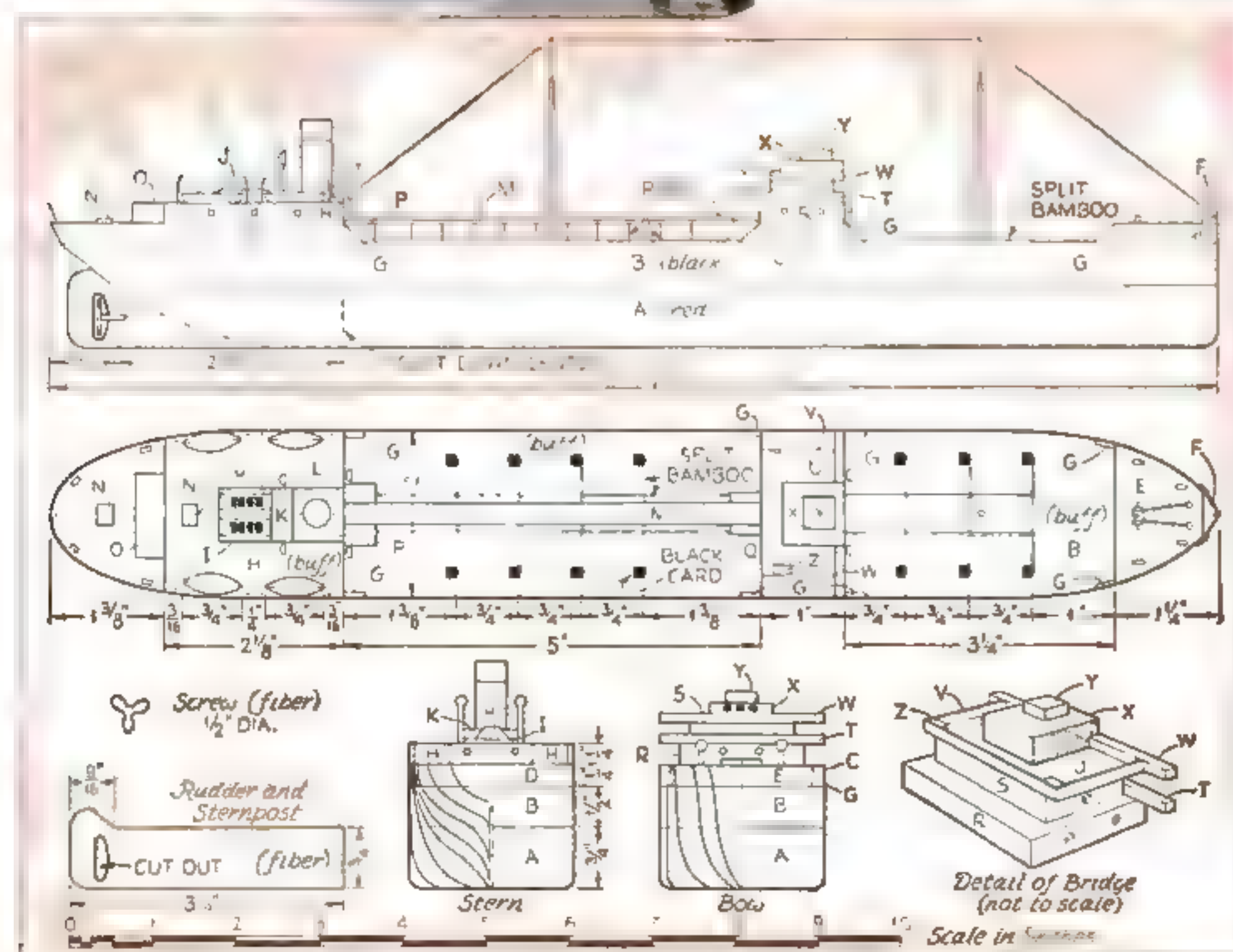
Proceed with the upper portion of the hull by fastening the triangular pieces G to the corners formed where C, D, and E join B. Now paint the sides black, the decks buff, and the edges of C, D, and E facing the decks, white.

Cut the remaining pieces to shape and assemble and paint the various units separately before *(Continued on page 93)*



Designed
especially for the
**POPULAR SCIENCE
MODEL-of-the-MONTH
CLUB**

By
Theodore Gommi



Side and deck views of the model; stern and bow views, showing the shape of the hull; a sketch of the bridge structure; and a detail of the rudder and sternpost. See list of materials for sizes

Cake-Tin Reflector

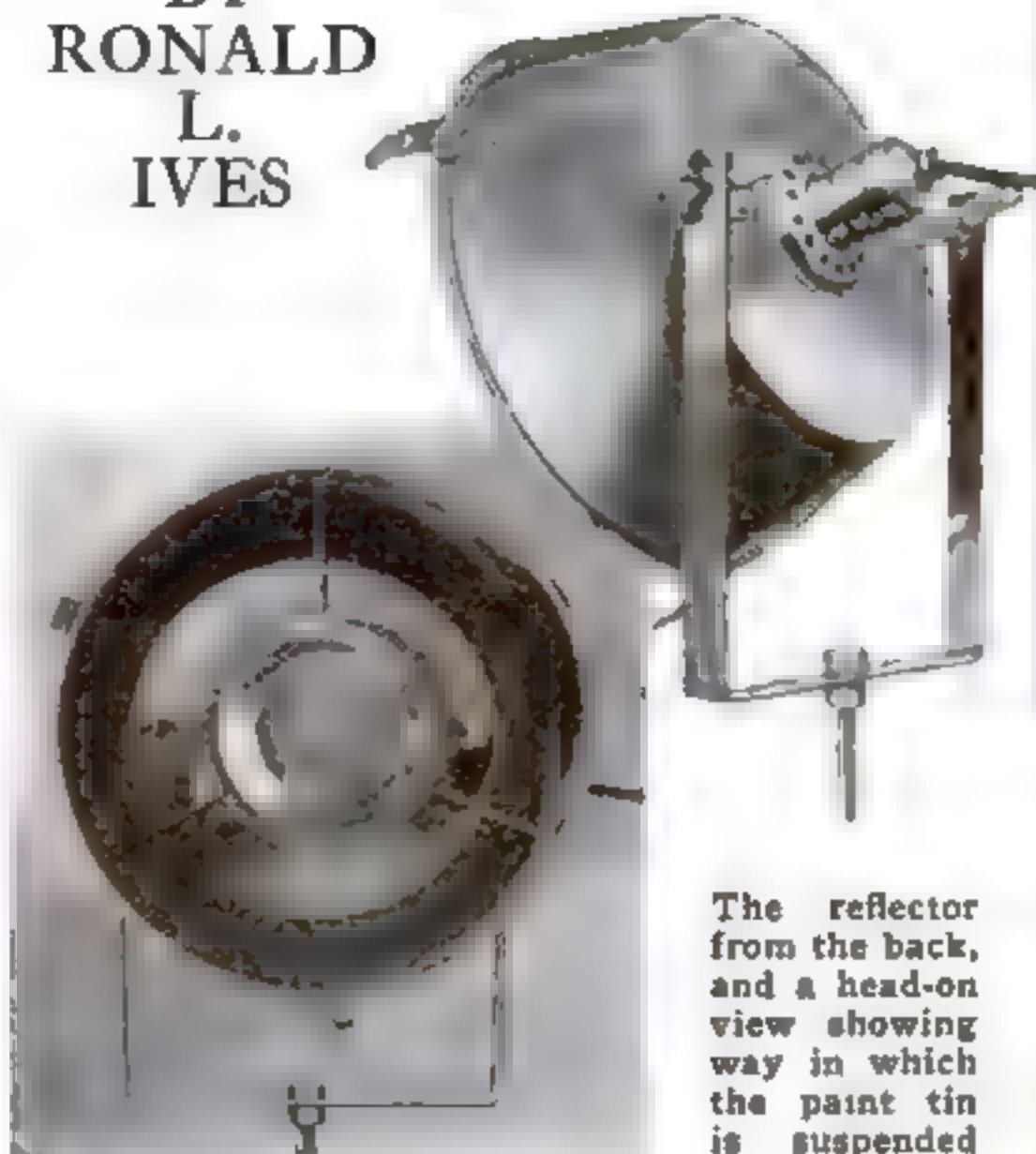
Gives Concentrated Light for

INDOOR PHOTOGRAPHY

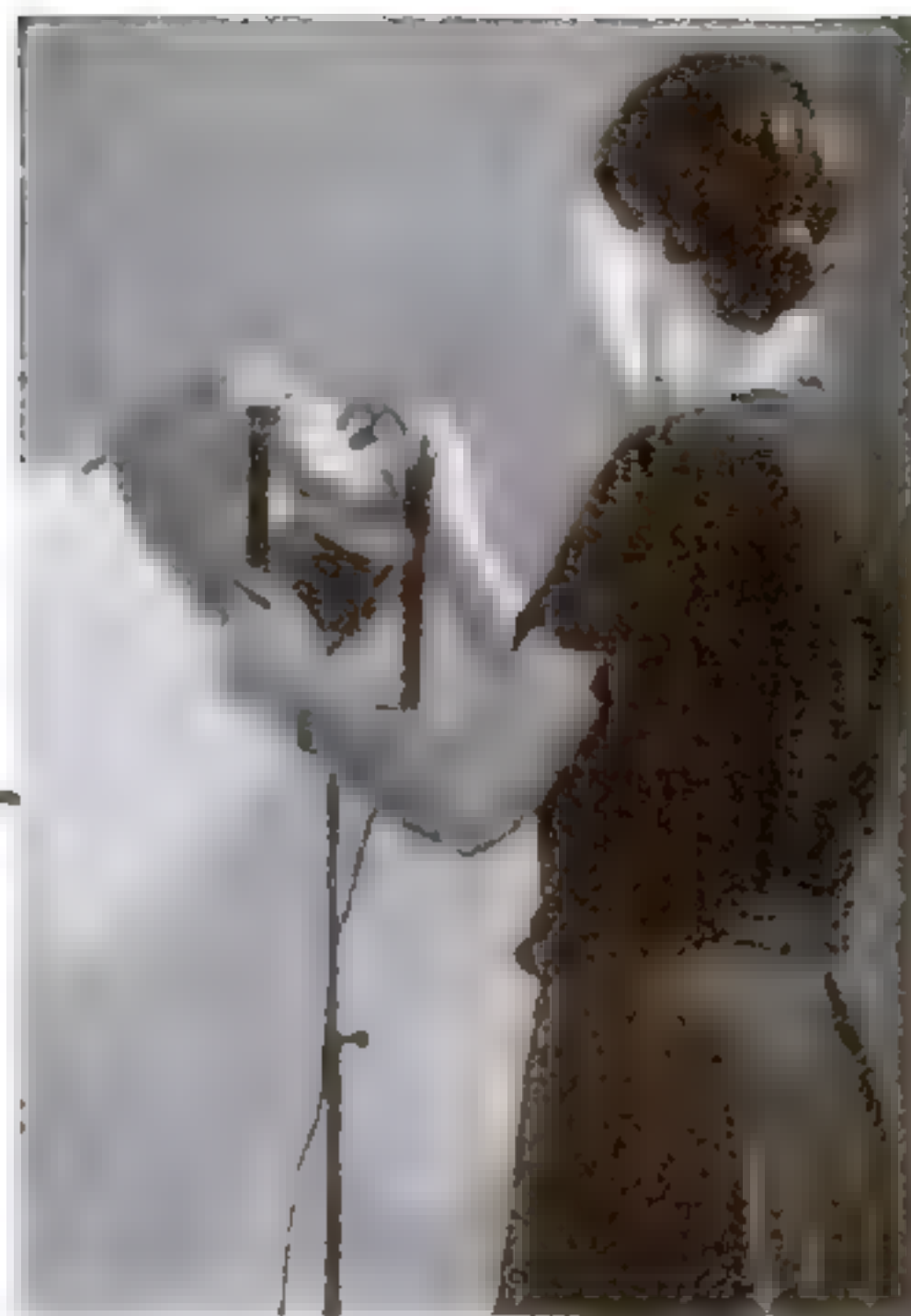
ALTHOUGH it compares favorably in efficiency with many expensive reflectors, this homemade photo-flood reflector for indoor photography can be built for less than \$2.50. It is easily assembled, does not throw a blast of heat, and directs the light where wanted. The necessary materials consist of a so-called "angel-cake" tin and a paint tin of the type illustrated, both from the ten-cent store; an old music stand bought in a junk shop (or a cheap new stand); and strap iron and angles from the hardware store.

For the main reflector, get a good angel-cake tin, preferably one of sheet iron plated with tin. Remove the con-

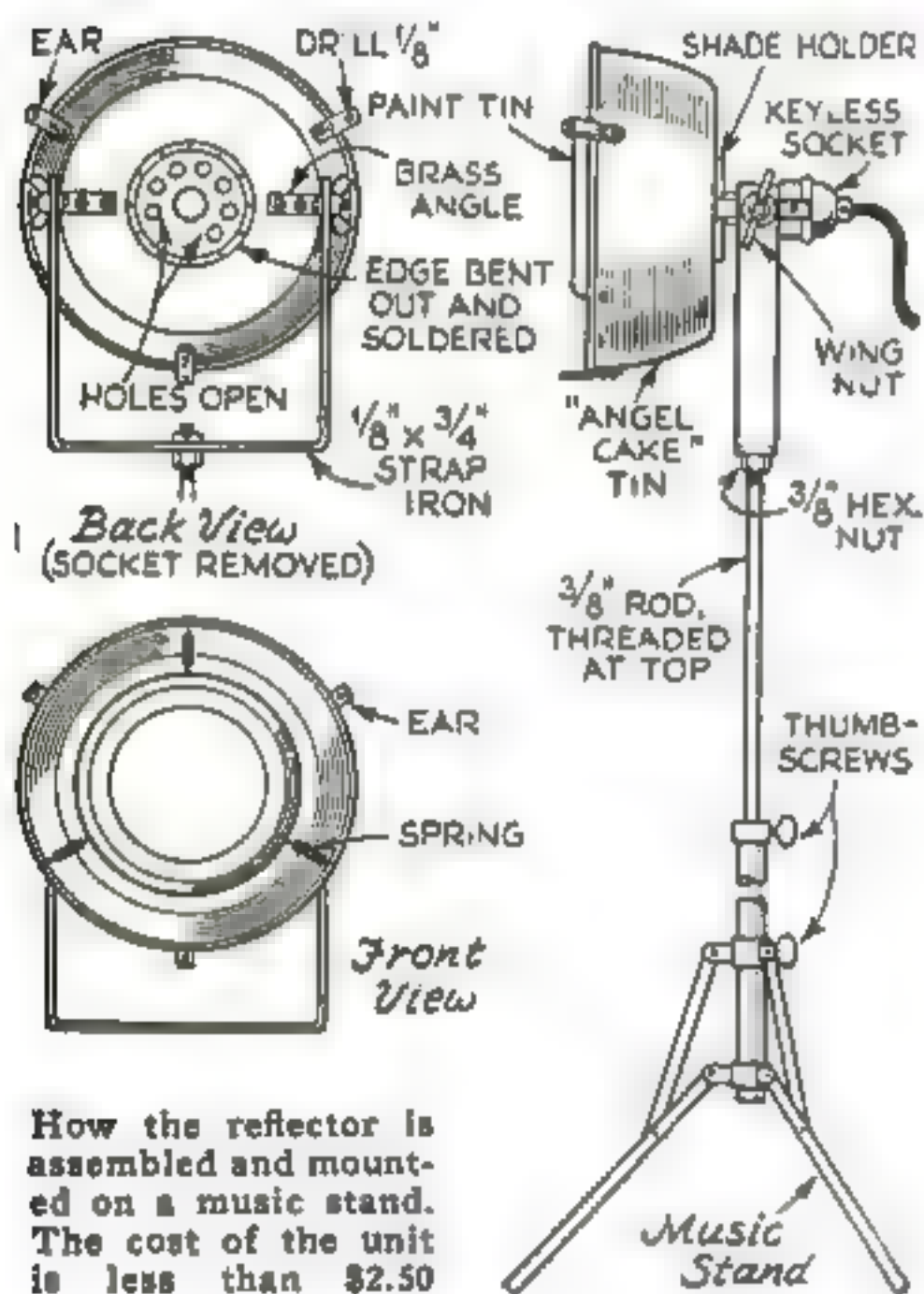
BY
RONALD
L.
IVES



The reflector from the back, and a head-on view showing way in which the paint tin is suspended



Thumbscrews at the sides of the reflector enable it to be tilted up or down as required



How the reflector is assembled and mounted on a music stand. The cost of the unit is less than \$2.50

cal central cone by grasping the core near the seam with a pair of pliers and twisting toward the seam. The core will pull loose from the bottom and come out without scarring the bottom. This will leave a hole slightly larger than a standard socket.

Obtain a lamp-shade holder of the kind stamped out of one piece of metal. Bend the lower rim outward until it is parallel with the top. Center the shade holder over the hole in the cake tin, pin it securely in several places, and apply solder. Pins are necessary because photo-flood lamps give enough heat to weaken solder.

At three places on the front rim of the cake tin, preferably opposite the three projecting ears, drill $\frac{1}{8}$ -in. holes for the springs which hold the secondary reflector in place. This reflector is made of a paint tin about $4\frac{1}{2}$ in. in diameter, with

three holes drilled in the rim about 120 deg. apart.

Screw a keyless socket into the reflector, and attach a cord and plug. Then screw a photo-flood bulb into the socket. Suspend the secondary reflector with springs over the center of the bulb and as close as possible without touching it.

Mountings for this reflector can be made to suit the materials available. The reflector illustrated has two brass angles screwed to opposite sides of the back. These angles fit into a U-shaped piece of strap iron, and thumbscrews at the joint allow the reflector to be rotated vertically. The strap iron is fastened to a $\frac{3}{8}$ -in. iron rod, which fits the music stand.

Small holes drilled in the ears of the cake tin allow the secondary reflector to be placed farther away from the bulb when it is desired to increase the side light and decrease the front light. This also enables the secondary reflector to be used with a larger (No. 4) photo-flood bulb.

A diffuser, made of tracing cloth stretched in a 10-in. embroidery hoop, may be held between *(Continued on page 102)*

IMPROVED CLOTHESPIN FILM HANGERS

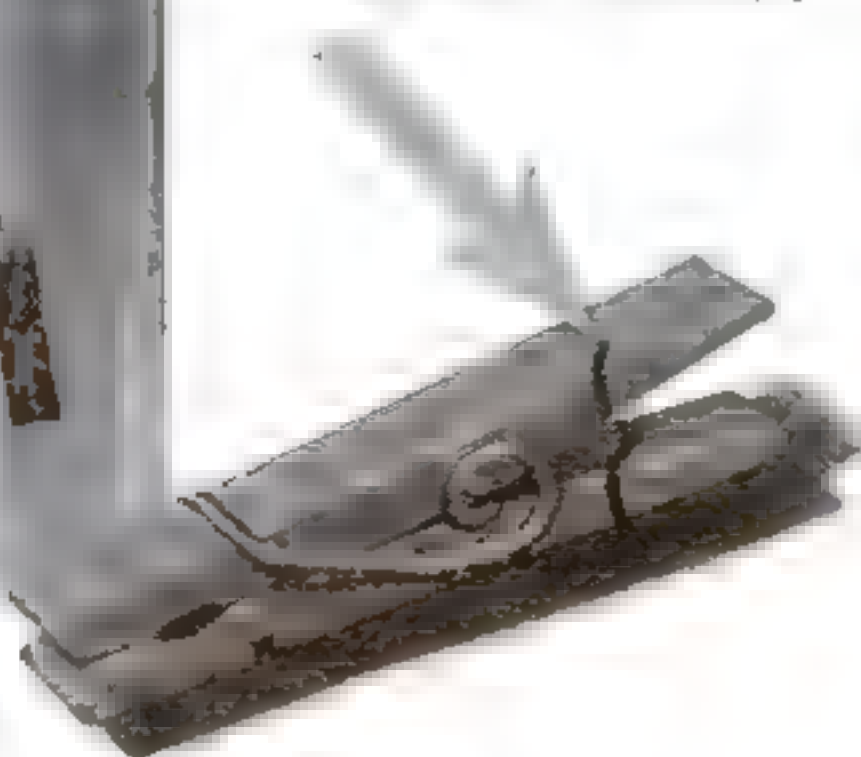
A SINGLE saw cut transforms the common variety of spring wooden clip or clothespin into an excellent hanger for drying films. One of the accompanying photographs shows the correct angle and location

of the slot. These slotted hangers have a distinct advantage over the type having a hook attached to one side, in that the films hang parallel to one another. Be careful, however, not to place them so close the films may touch.

—MICHELE DESANTIS.



If a slot is cut in a common spring clothespin as indicated at the right, it becomes an excellent hanger for films. The slot is merely hooked over the line



RULED TEST FILM USED TO FOCUS ENLARGER

NEEDLE-SHARP enlargements may be assured by the use of a focusing film. Soak an ordinary film—one that has been discarded—in warm water and rub off the emulsion. Then, after the film has dried, use a draftsman's ruling pen and India ink to rule a pattern of squares and diagonals on what was formerly the emulsion side. By projecting this test film as shown above, the easel may be accurately adjusted and the focus set.—K. M. S.

NOW Kodaks work NIGHTS

It's easy to take pictures AFTER DARK

IF YOU'LL run through almost any collection of pictures, you're pretty sure to find that some of the finest are indoor shots—taken at night. For today films are faster; lighting has been improved. You'll enjoy testing your skill in this new and exciting sport; tonight's a good night to start.

Night pictures can be made with your present camera provided that it can be set for "time"; and if it boasts an *f.6.3* or faster lens, night *snapshots* are easily possible. Just load with Kodak "SS" or Kodak Verichrome Film and use Mazda Photoflood or Photoflash lamps.

FREE BOOKLET

First get the FREE booklet on Night Pictures at your dealer's . . . then you're ready to shoot. It explains everything about pictures at night...which film to use...how to set your camera...suggests a variety of picture opportunities . . . Eastman Kodak Company, Rochester, N. Y.



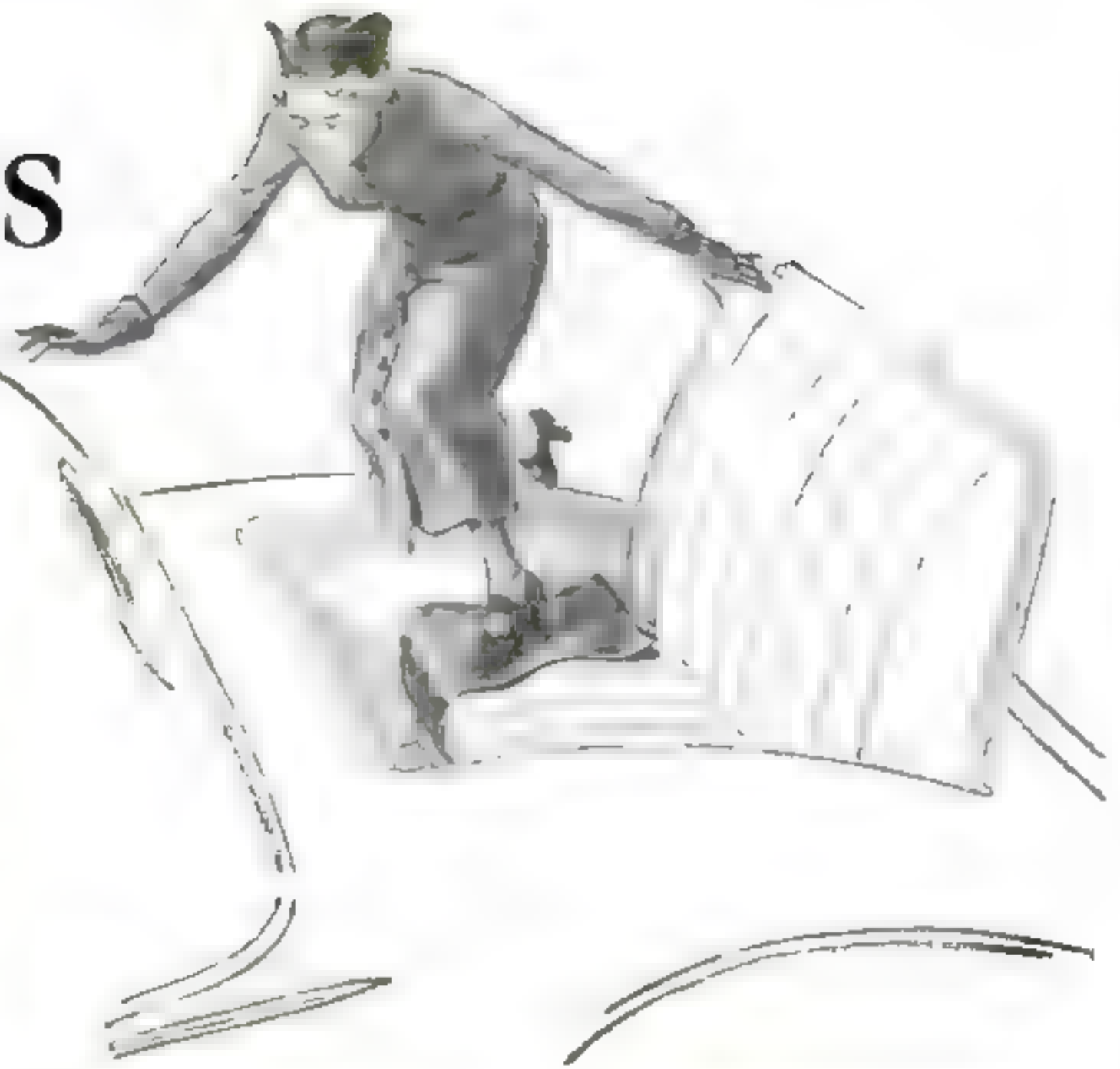
Accept nothing but the film in the familiar yellow box.

Timely Hints FOR CAR OWNERS

Leather Pad Protects Rumble Seat

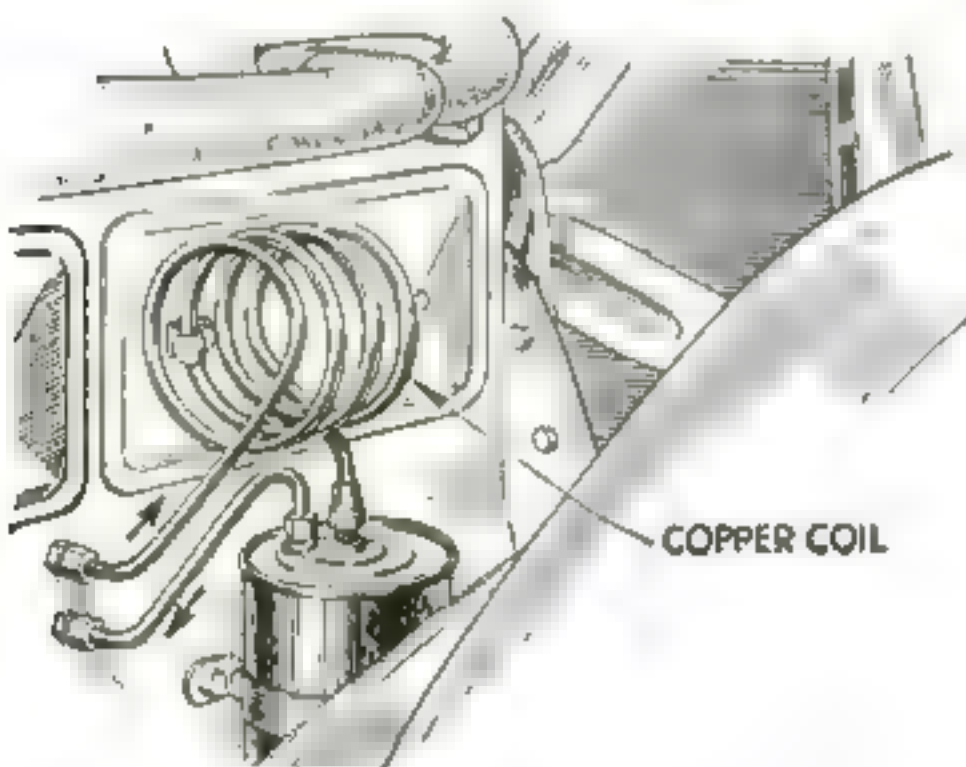
AFTER trying in various ways to protect the rumble seat in my car from the wear and tear caused by passengers stepping on the upholstery when they climb in, I hit on the idea illustrated at the right. Buying a rectangular piece of soft leather for a few cents, I fastened one end of it under the front edge of the

seat. Now when passengers climb in, I simply place the pad over the seat. When not in use, it can be folded out of the way. Besides protecting the upholstery, the pad also serves to keep the seat clean.—G. J.



Rubber Strip Stops License-Plate Rattle

LICENSE plates that have a tendency to rattle can be silenced easily by installing a narrow strip of rubber between the plate and the mounting bracket. The rubber can be cut from an old inner tube or from a discarded section of rubber floor mat. If thin rubber is used, several layers may be necessary to insure against any possibility of metal-to-metal contact. Holes should be punched in each end of the rubber to take the mounting bolts.—W. C. F.



Inexpensive Oil Cooler

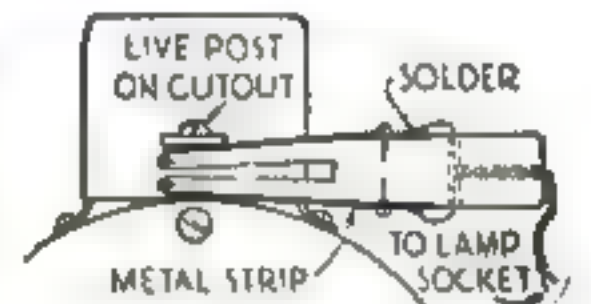
WITH a six-foot length of copper tubing, the amateur mechanic can provide his car with an efficient oil cooler. The tubing, equal in diameter to regular oil-feed pipe, is wound around a five-inch diameter pipe to form a spiral and connected as shown into the oil-pressure line. The air from the fan, circulating around the coil, will cool the oil and prevent excessive thinning. To prevent vibration, one or two turns of the coil can be rigidly anchored to the motor block.—E. J. N.

Trouble-Light Plug

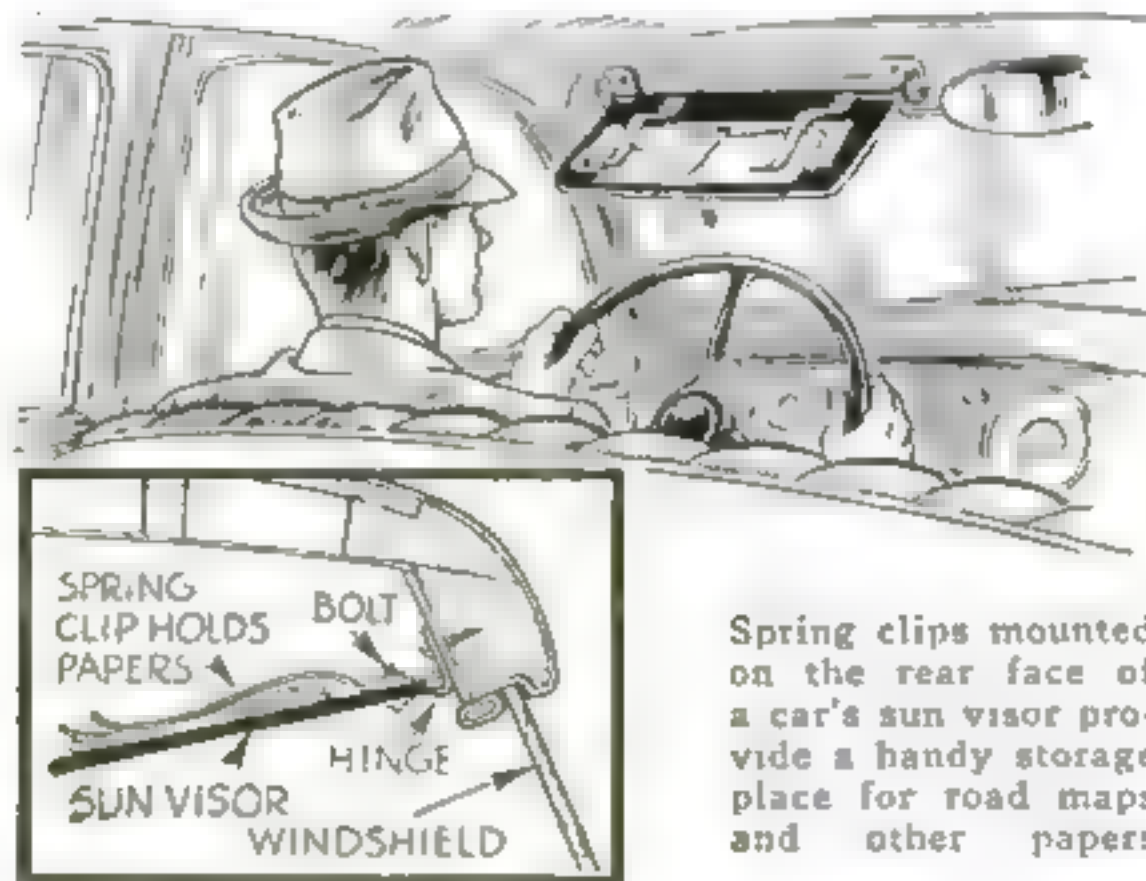
RESEMBLING a telephone plug, the handy attachment illustrated makes it an easy matter to connect a trouble light into a car's battery circuit. Made from a piece of springy wood and provided with two strips of copper or brass to form contacts, the connector in use is inserted under the terminal clip at the side of the generator cut-out. The upper metal strip contacts the cut-out terminal, and the lower strip completes the circuit by touching the generator frame. A slot cut in the tip of the plug supplies sufficient springiness to insure good contact.—W. C. W.



A connector, made as shown at right, inserted under the cut-out terminal will provide power for a trouble lamp



Stores Road Maps Over Sun Visor



Spring clips mounted on the rear face of a car's sun visor provide a handy storage place for road maps and other papers

FINDING that the adjustable sun visor on my new car provided a handy place for storing road maps, letters, and other papers, I installed two clips to hold them in place when the visor is pulled down. The clips, bent from spring steel, were mounted with small bolts passed through holes drilled in the visor. When touring, I fold the map so the desired portion is exposed and slip it under the spring clips where it can be referred to easily and quickly. The clips also provide a handy place for storing sun glasses.—E. E. S.

Valve Springs Stiffen Old Radiator Hose

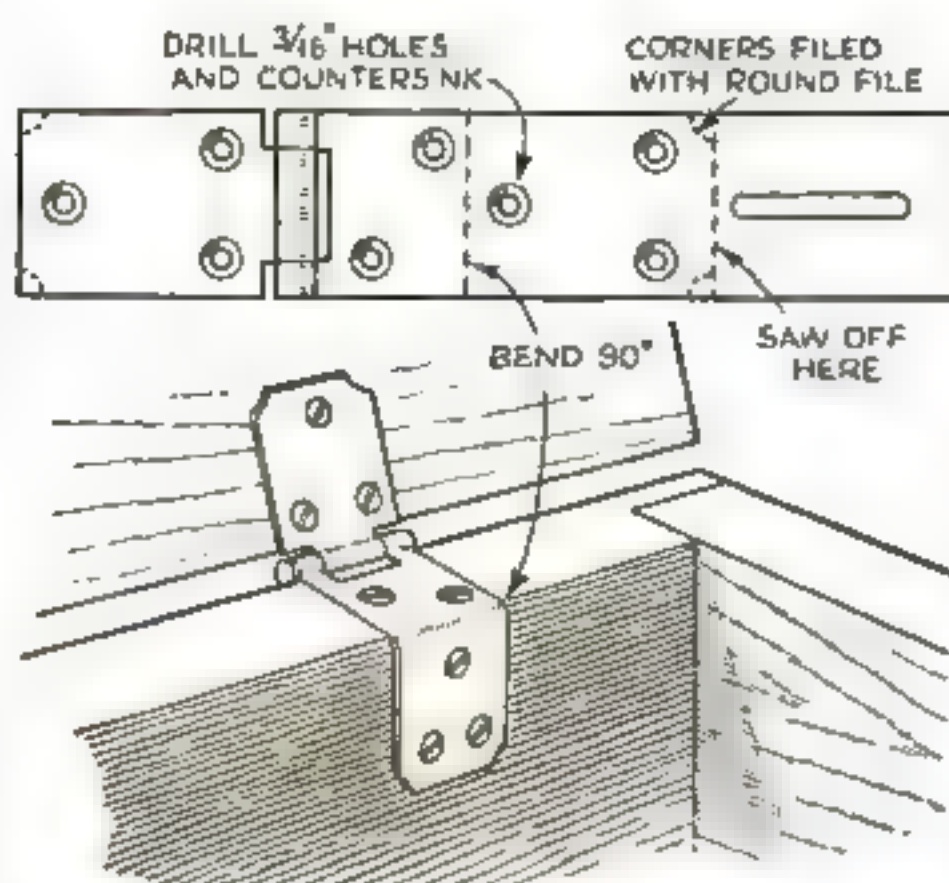
MANY motor overheating problems can be traced directly to an old and weakened hose connection on the vacuum side of the radiator. At high motor speeds, the thin walls of the weakened hose collapse under the vacuum produced by the increased flow of water and completely stop the flow. Although a new connection is the best remedy, an inexpensive emergency repair can be made by disconnecting the lower end of the hose, inserting a few old valve springs, and refastening the connection. The springs will offer no appreciable obstruction to the circulation of the water, but will prevent the walls of the hose from collapsing.—W. L. B.



Waxing Plated Parts

HEAVY waxed paper of the type used to wrap bread forms a handy material for protecting the plated metal parts on your car from rust. Warmed and rubbed briskly over the metal, it will deposit just enough wax to form a protective coating.—G. A. T.

OFFSET CHEST HINGES MADE FROM HASPS



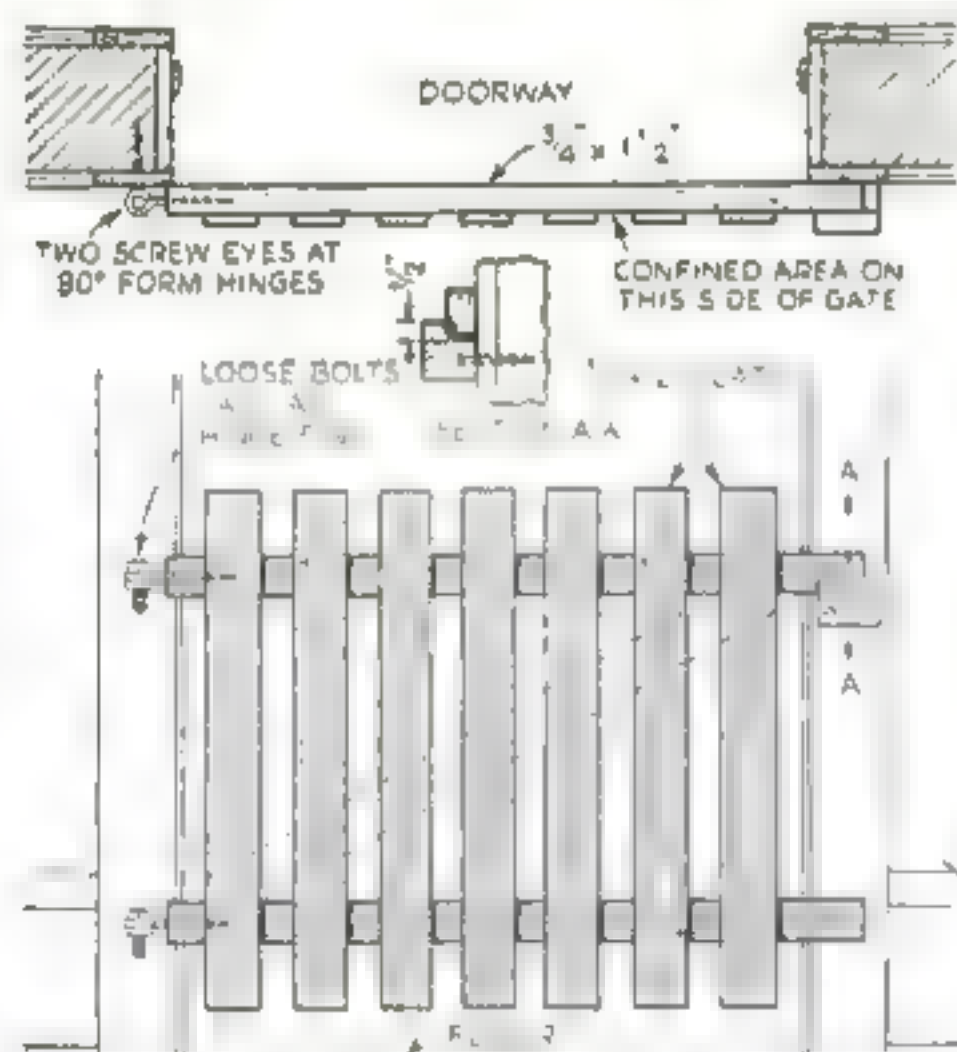
How the hasp is cut off, bent, and drilled to serve as a substitute for a chest hinge

CHEST hinges may be constructed from hinge hasps of the type shown above by cutting off the eye for the staple with a hack saw and bending the remaining piece to fit over the edge of the chest. Such hinges have the advantage of fitting any width or thickness of wood. The holes should not be drilled until after the bending has been completed, and may be countersunk with a larger drill to fit flathead screws. To make the hinges more attractive, the corners may be filed as indicated with a rat-tail file.

Solid brass hasps are used by the writer, although iron ones will serve the purpose just as well.—CARL CLUNY.

SCREW-EYE HINGES USED ON NOVEL SAFETY GATE

ALTHOUGH designed to prevent a puppy from running all over the house, this gate may also be used for keeping a small child in a room. It is made with $\frac{3}{4}$ by $1\frac{1}{2}$ -in. cross members and $\frac{1}{4}$ by 2-in. slats, fastened



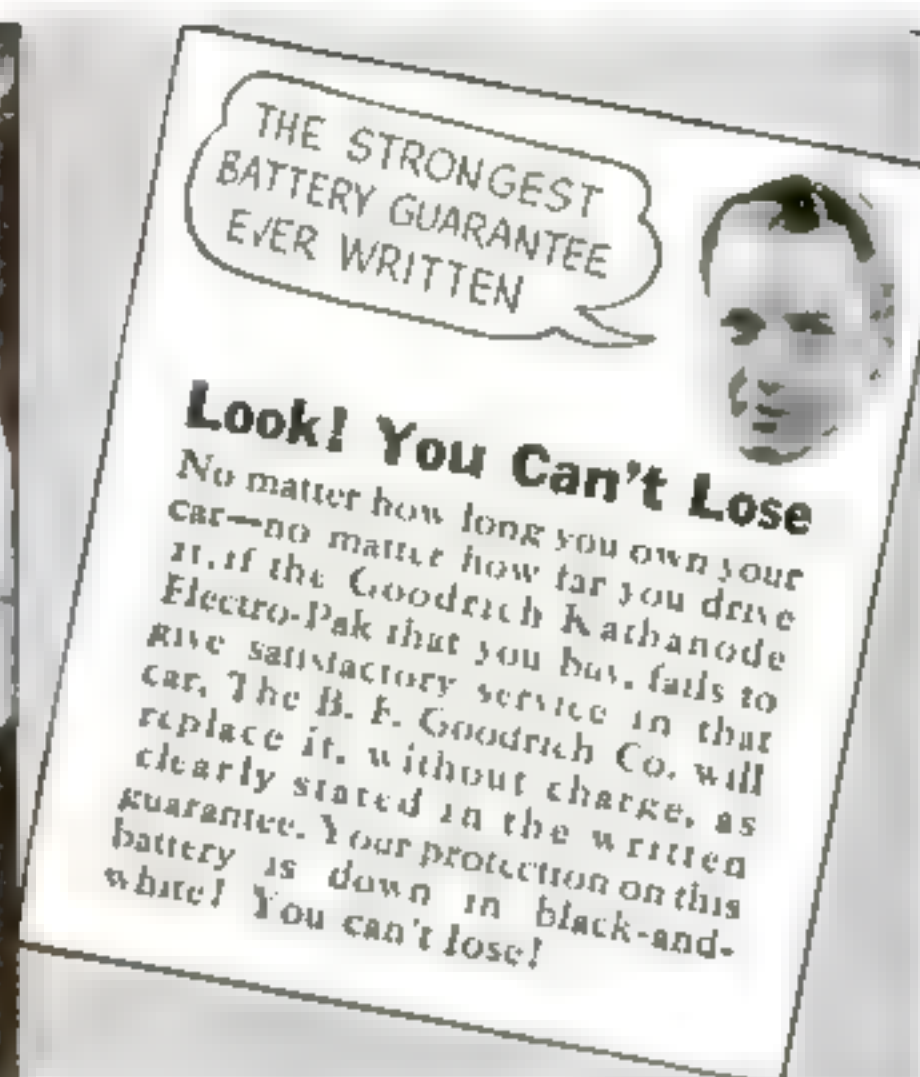
Removable gate for use across doorway or to prevent a small child from falling downstairs

with small brads. A light diagonal member, shown dotted in the diagram, may be added if desired.

Screw eyes are used for the hinges, and small bolts for the hinge pins. This type of hinge allows the gate to be lifted sufficiently to latch it in place. The latch piece, which is a small block of wood with a $\frac{1}{2}$ -in. shoulder as indicated, is screwed to the door jamb. The end of the top cross member is notched to fit the latch piece. By taking out the bolts or hinge pins, the gate may be removed whenever necessary.—LAWRENCE N. OLSEN.

THIS NEW-TYPE BATTERY GUARANTEED AS LONG AS YOU OWN YOUR CAR!

We stand back of the New Goodrich Kathanode Electro-Pak Battery whether you drive your car 3,000 or 300,000 miles



Only Goodrich Electro-Pak Batteries have the Power-Saving Top Cover

IMAGINE getting a battery so powerful that it will start heavy motors *double-quick* on the coldest days and so ruggedly built that no matter how long you own your car you'll never have to buy another battery for it—or spend a penny on repairs! Yet that's exactly what you get in the new *guaranteed* Goodrich Kathanode® Electro-Pak.

And because the life of a battery depends on the life of the plates, this new Electro-Pak Battery is built with the remarkable *patented* Kathanode construction—famous for its use on airplanes, submarines and railroads—consisting of flexible, porous, spun glass retainer mats specially designed to prevent the loss of the real power-producing materials in the plates. Thus the plates last much longer.

A marvel for power

No wonder the Kathanode Electro-Pak has such an amazing long life. No wonder it gives *extra* protection against dangerous short circuits inside the battery. You can be dead certain that only with a battery as powerful as this—only with a battery so revolutionary in construction could Goodrich make such a sweeping guarantee—the most sensational ever made on a battery in the history of motoring.

*Made under the Kathanode Patent.

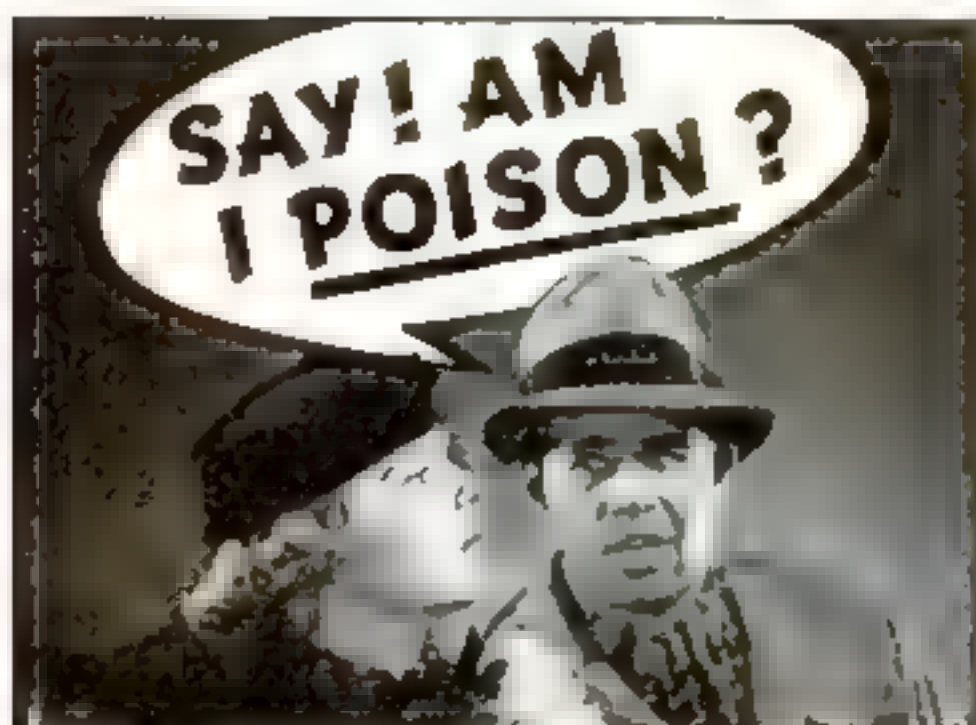
Save money, time and trouble this winter. Ask your Goodrich Tire dealer to show you the new Goodrich Kathanode Electro-Pak—the battery that is guaranteed as long as you own your car. And remember, there is a Goodrich Battery for every need and pocketbook.



Double Protection!

And another big reason why this new Goodrich Kathanode Electro-Pak will save you money and trouble is its exclusive Power-Saving Top Cover. Dirt, corrosion and acid film that collect on top of ordinary, unprotected batteries and often waste enough power to burn an ordinary flashlight bulb continuously, are shut out of the new Electro-Pak. You get all the power you pay for in this battery—for bright lights, quick starts and all the power-eating equipment on modern cars.





BUBBLE PICTURES SHOW WHY!



MOST LATHERS are made of bubbles too big to get to the base of the beard! Air pockets keep the soap film from reaching the whiskers. So the beard is only half-wilted.

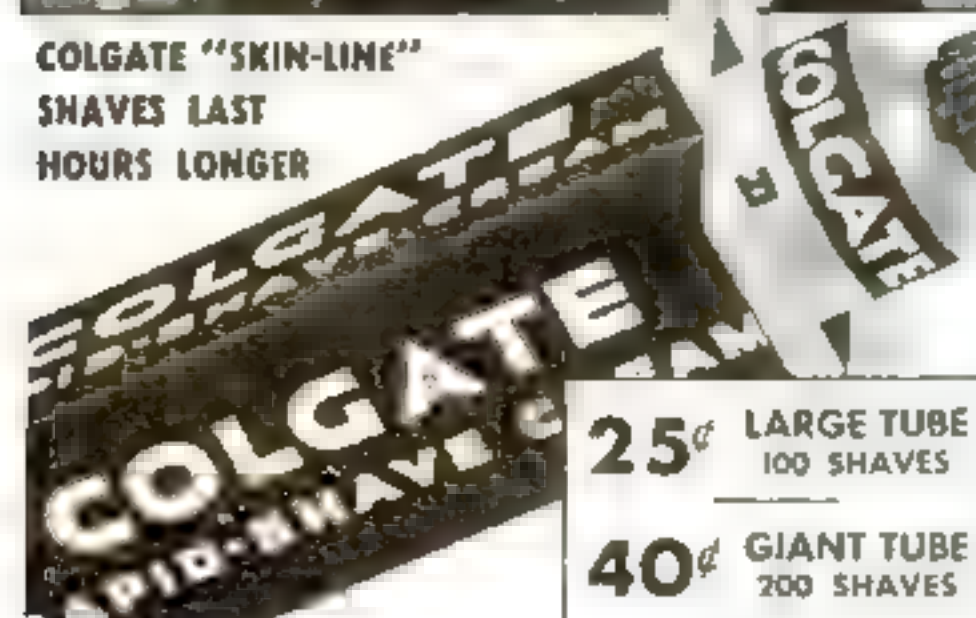


COLGATE RAPID-SHAVE CREAM makes tiny bubbles that get clear down to the skin-line. Its rich soap film soaks your beard soft at the base. Makes your shaves last longer.

THE NEXT DATE



COLGATE "SKIN-LINE" SHAVES LAST HOURS LONGER



Colored Celluloid Letters

GLOW
LIKE NEON
TUBES



A sign of interchangeable block letters scroll-sawed from wood and set off by red celluloid strips, which are placed in slots as illustrated at the right. This gives a neon effect

By
KENNETH MURRAY

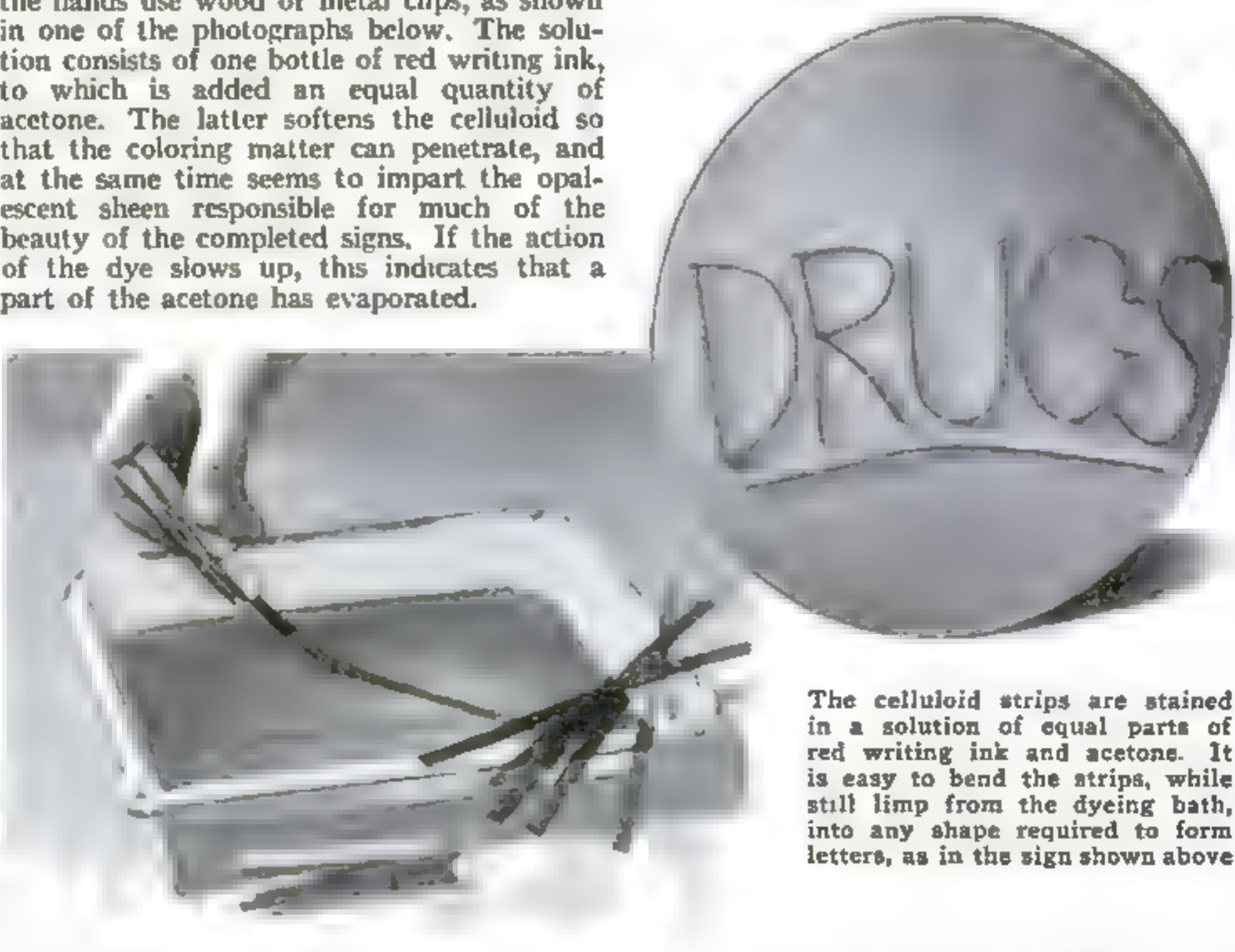
ARTISTIC signs that give the appearance of glowing neon tubes can be made from narrow strips of red celluloid. The process is simple, takes but a few minutes, and while the effect depends on an optical illusion, it is surprisingly realistic. If the sign is well made and placed in a favorable light, it requires a reasonably close examination to reveal that the letters are not in some way illuminated by electricity.

The letters, for ordinary use, can be attached with waterproof cement to glass or any light-colored surface. This is the most convenient method to follow for outdoor signs and house numbers. When cemented to mirrors, they are especially brilliant; and changeable block letters of the type shown in the illustrations above are useful for making up window advertising signs.

Automobile side-curtain celluloid is satisfactory for the purpose, if it is cut into strips about $\frac{3}{8}$ in. wide. The red color is applied by dipping, and to avoid staining the hands use wood or metal clips, as shown in one of the photographs below. The solution consists of one bottle of red writing ink, to which is added an equal quantity of acetone. The latter softens the celluloid so that the coloring matter can penetrate, and at the same time seems to impart the opalescent sheen responsible for much of the beauty of the completed signs. If the action of the dye slows up, this indicates that a part of the acetone has evaporated.

Immediately after leaving the tinting bath, the strips will be found quite limp, and in this condition they can be formed into letters and numerals quite easily. They will retain their shape permanently when dry. The letters in the sign advertising drugs were shaped in this manner and then fastened with cellulose cement to a disk of wall board. This type of cement is most satisfactory because it is both waterproof and transparent.

Block letters for making signs such as the one at the top of the page are cut on the scroll saw from plywood and then varnished. Instead of cementing the celluloid in place, a thin scroll saw blade is used to cut slots into which the strips can be fitted, as shown in one of the illustrations. These letters can be used anywhere and may be fitted with brads so that they can be pressed against any smooth surface. It is not necessary that the letters be given special attention as regards lighting, as the effect is practically the same in daylight and in artificial light.



The celluloid strips are stained in a solution of equal parts of red writing ink and acetone. It is easy to bend the strips, while still limp from the dyeing bath, into any shape required to form letters, as in the sign shown above

TRICK MARIONETTES

(Continued from page 73)

principle, a gallant may be made to put his hand on his heart as he bows, by attaching a ring to his chest and passing the hand string through it (Fig. 9). A deaf man will cup his hand behind his ear if a ring or screw eye is placed to direct the movement (Fig. 11), and a child appears to be crying if his hands are brought up to the eyes (Fig. 10).

One of the photographs shows a knight drawing his sword from its scabbard. A string passing through a hand and attached to an object will draw it out, as in this case. In the same way, a handkerchief can be pulled out to wave as occasion demands.

TWO scenes from *Alice in Wonderland* are shown in the photographs. Alice may be made to "open out like the largest telescope." If you already have a modeled head you can use, just glue a strip of firm cardboard around the throat, paste muslin over this, and paint a flesh color. Cut a piece of soft white fabric to fit the body and nail it to the shoulders, tapering it to fit the throat above and making a small turnover for a collar. Glue or paste this around the cardboard and drive in a few tacks for extra security. Tie an extra string to a screw eye driven in the top of the head and attach this to the center of the stick that controls the strings fastened near the ears. This string must be longer than the others; in fact, very slack so that the head, when loose, will drop down on the shoulders in a natural position. By lifting the string, the neck will be elongated. The famous Scaramouch is often shown with this extension throat.

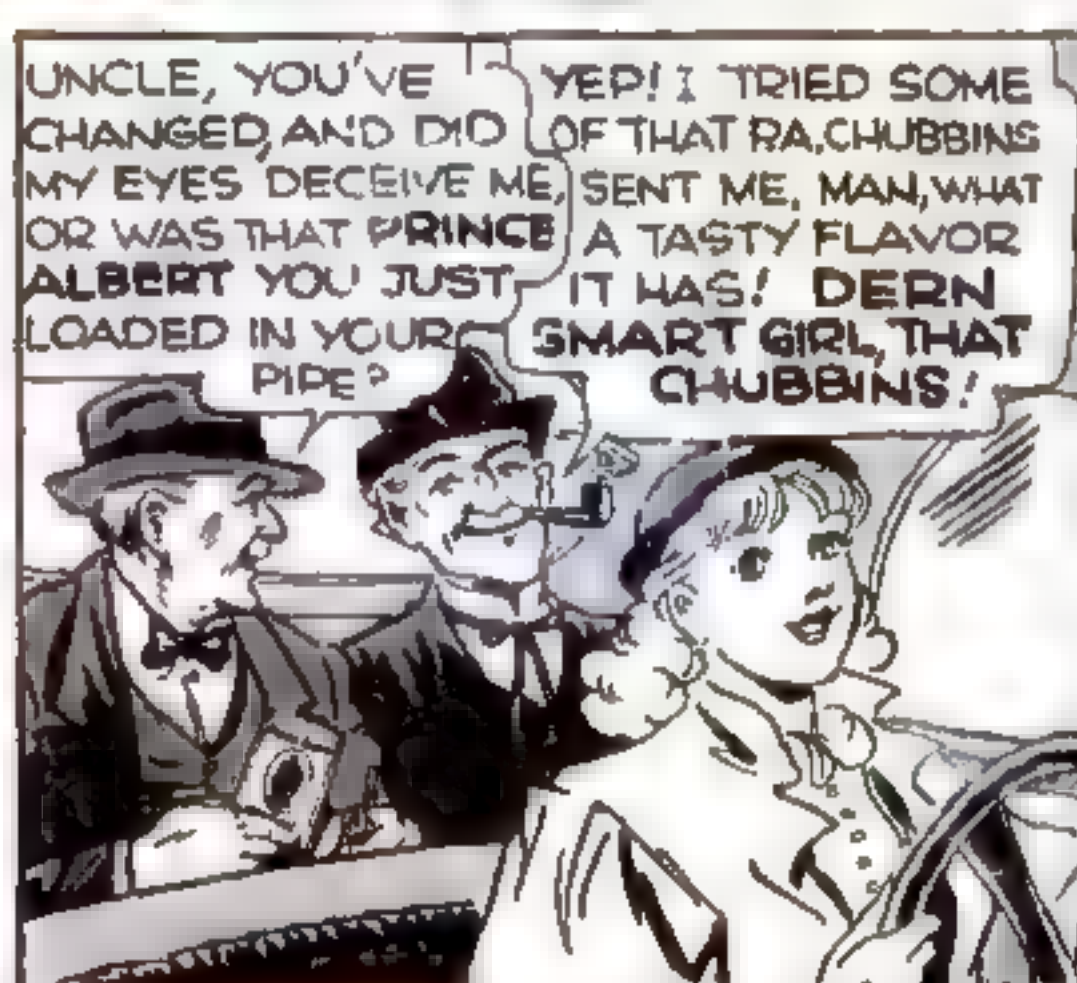
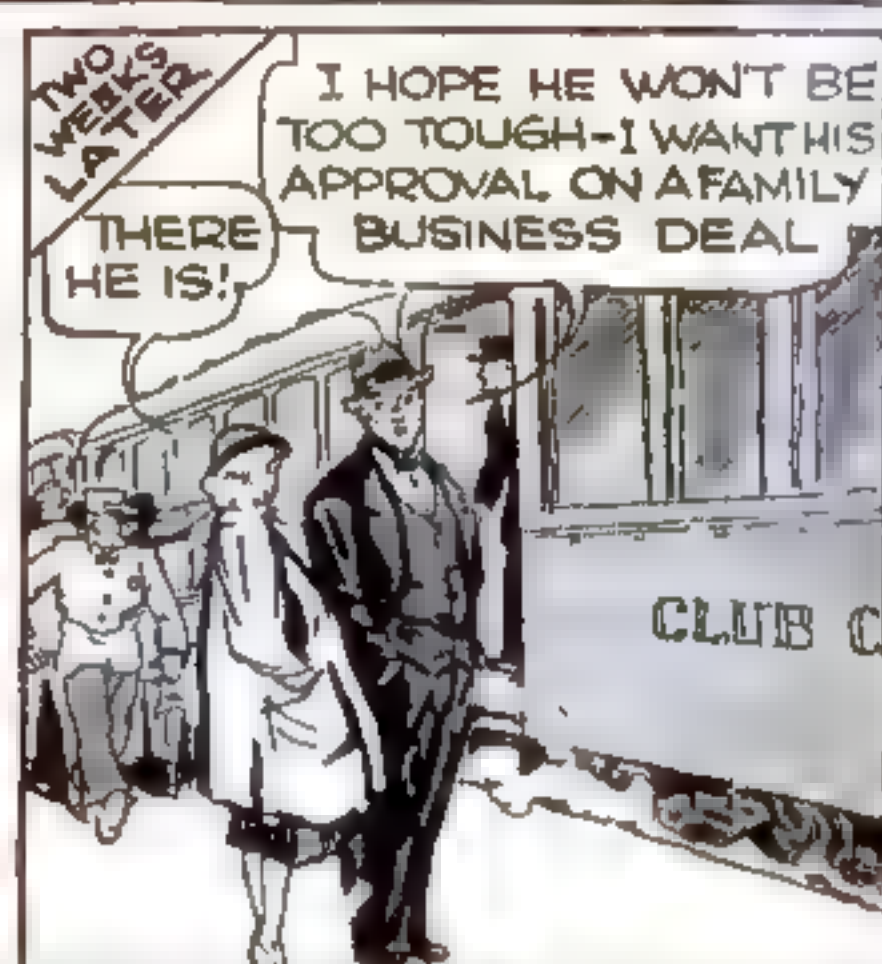
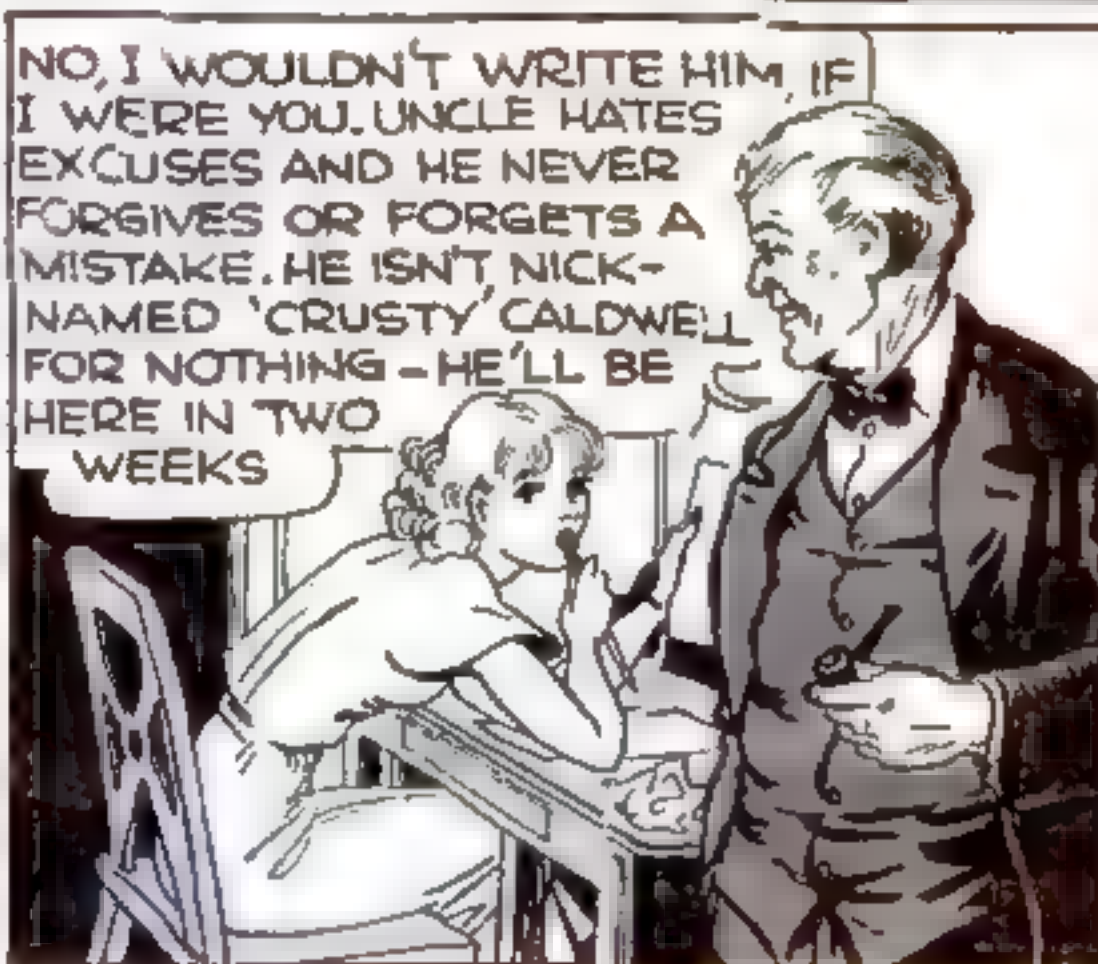
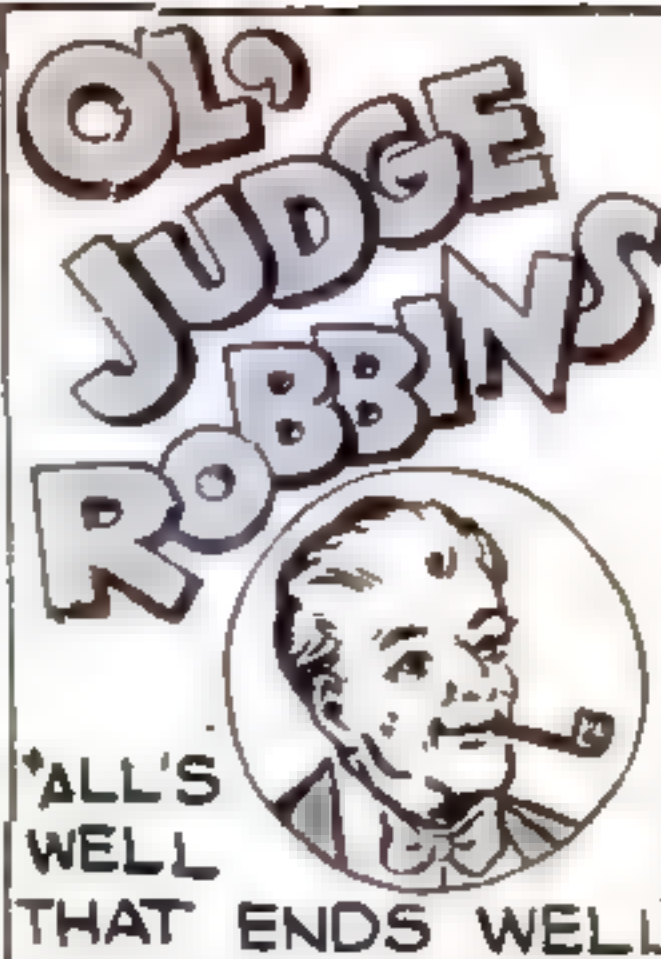
Father William appears in one of the photographs showing his son how young he is by standing on his head. This stunt is performed by attaching a string to each heel and tying these to an extra control stick. If an airplane control is used (Fig. 12), drive a nail through stick No. 1 just back of No. 2 to hold the regular leg stick, and one just in front of No. 2 for the heel stick, so it can be slipped over the nail when not in use and thus be out of the way.

The marionette piano player shown in another of the photographs is made exactly like those described in previous articles in this series (see note at end of this article) except that the hands are made more carefully to fit them for pounding the keys. The hands from the wrist down are of sheet lead, each finger and thumb cut separately; then the hands are covered with two layers of muslin, glued on. Between the first and second layers, the hands are built out a bit with cotton to give them the required thickness. They are attached to wooden lower arms with wire loops, which should have muslin glued over to form a hinge. Finally the hands are given a coat of flesh-color paint.

Draw the hand strings through the center of each palm and bend the lead fingers at an angle to the middle joint so the hammer touch can be given. In manipulating, it is important for the puppet to sit firmly on a bench or stool.

Ghosts and phantom figures, made as suggested in Fig. 13, are always entertaining. Fine copper wire is used to form the framework for the head. Two pearl beads are strung on the wires to form eyes, and the back of the head is covered with a triangular bit of orange-colored cellulose. A square piece of chiffon or some other diaphanous material is folded to form a triangle, the middle part being attached to the head. Wire-covered hands are sewed to the two upper points halfway from the throat. Only one controller is needed.

This article is the ninth in a series by Mrs. Drake on the construction of puppets and marionette theatres. In two early articles she told how to make marionettes from old inner tubes (P.S.M., Sept. '35, p. 58, and Dec. '35, p. 67). This year's articles have been as follows: puppet heads, P.S.M., Jan. '36, p. 57; marionette bodies, Feb., p. 64; marionette stages, Mar., p. 64; stage sets and scenery, Apr., p. 71; stage properties, May, p. 70; and miniature stage lighting, July, p. 67.

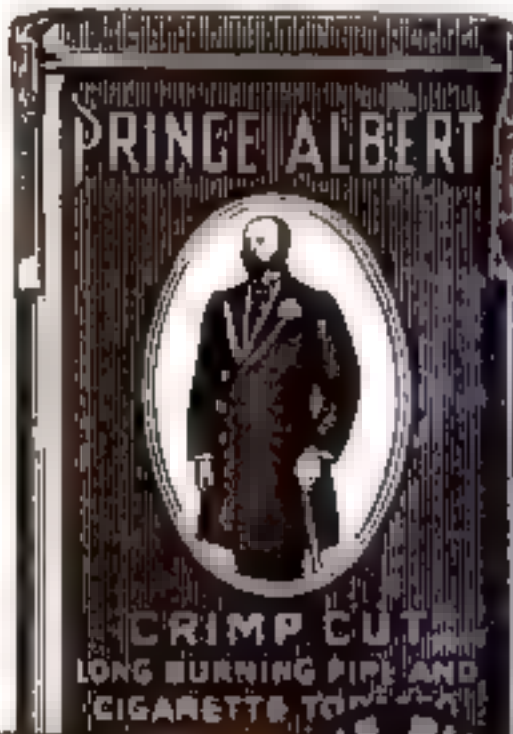


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COOL, MILD, TASTY SMOKING



Right on the Prince Albert tin it says: "Prince Albert is prepared under the process discovered in making experiments to produce the most delightful and wholesome tobacco." Prince Albert is "crimp cut," with the "bite" removed, made of choice tobaccos. Make Prince Albert your tobacco! P.A. is swell roll-your-own "makin's" too.



PRINCE ALBERT GUARANTEES SATISFACTION

Smoke 20 fragrant pipefuls of Prince Albert. If you don't find it the mellowest, tastiest pipe tobacco you ever smoked, return the pocket tin with the rest of the tobacco in it to us at any time within a month from this date, and we will refund full purchase price, plus postage. (Signed) R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

PRINCE ALBERT THE NATIONAL JOY SMOKE!

50 pipefuls of fragrant tobacco in every 2-ounce tin of Prince Albert

"PLUG UP" Old Screw Holes with WOOD in cans



Force Plastic Wood into old screw holes, even off; when dry, paint or varnish will completely hide the holes. Hinges can be replaced in the same holes after plugging with Plastic Wood.

MAKE 1001 PERMANENT HOUSEHOLD REPAIRS

Genuine Plastic Wood makes household repairs so easily—yet permanently—use it to fill old nail and screw holes, broken furniture, holes in baseboards, floors; cracks in shelving, leaky window frames; boat repairs, reset bathroom fixtures, loose tiles; holes around pipes, under paint, modeling decoys, fishing lures, cover countersunk screws, reset loose casters, replace wood rot, puppet making, etc.

SIMPLE TO USE

Genuine Plastic Wood is real wood in soft, pliable form—when dry it is hard, permanent wood that can be carved, sawed, turned on a lathe, whittled—will hold nails and screws without splitting, cracking or crumbling. Genuine Plastic Wood adheres to any clean, dry surface—wood, metal, stone or porcelain. Genuine Plastic Wood is waterproof, weather-proof and greaseproof, comes in nine different colors to match the object repaired, can be painted and varnished perfectly.

Get your can or tube of Genuine Plastic Wood for few cents at any paint or hardware store.

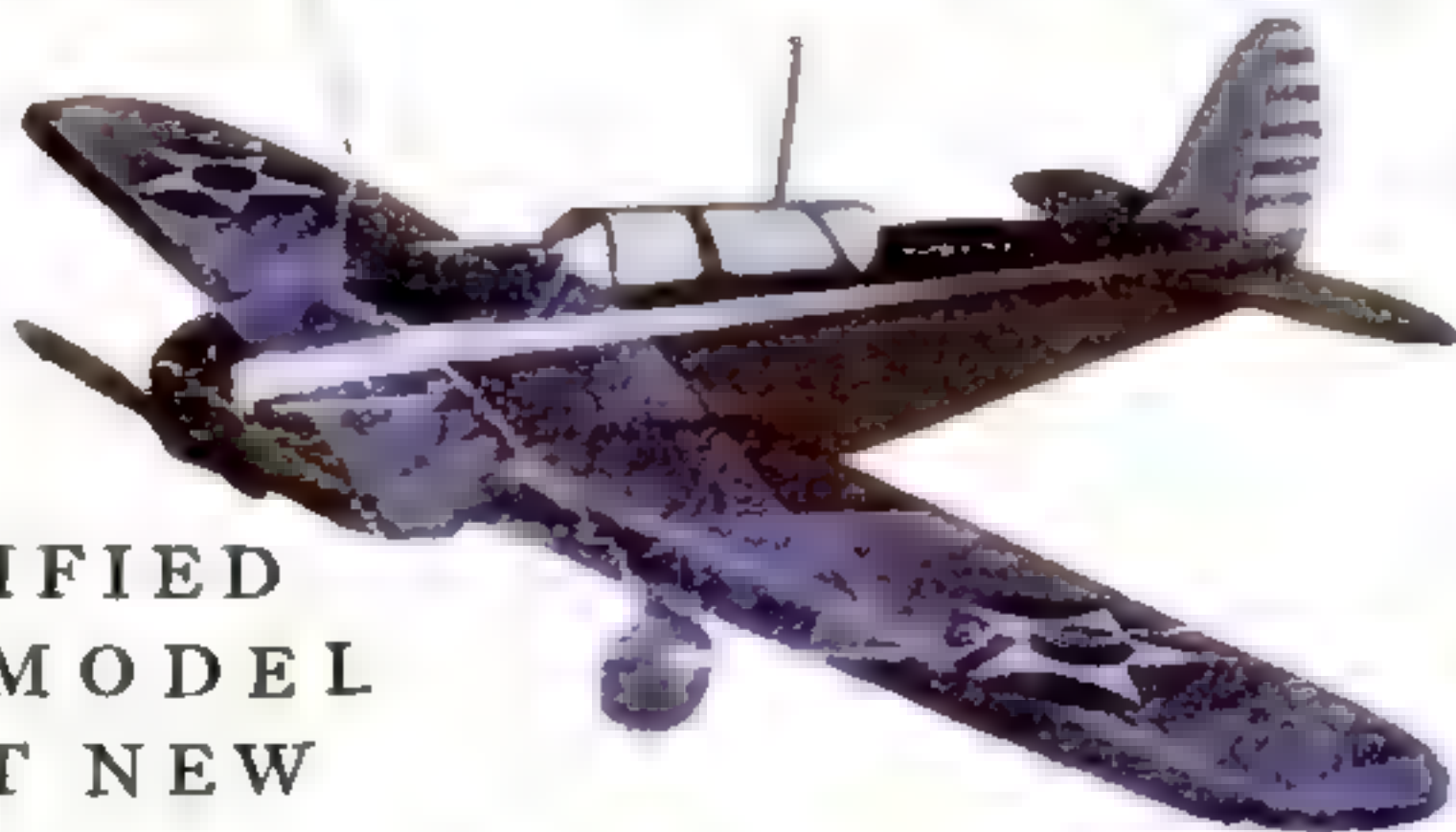


PLASTIC WOOD

By
Donald W.
Clark

SIMPLIFIED
SCALE MODEL
OF FAST NEW

Two-Place Attack Plane

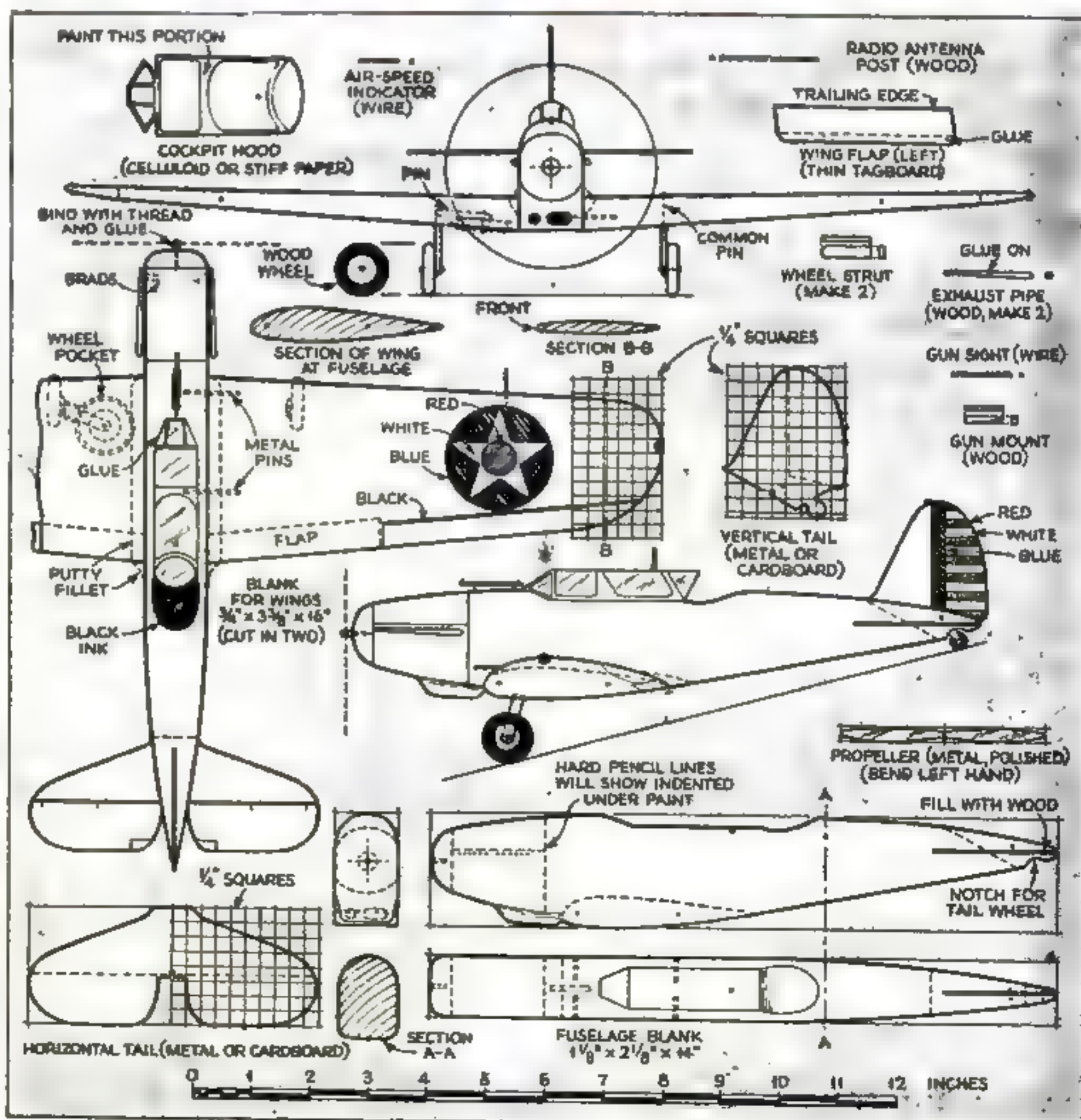


Two views of the underside of the model, one showing the wheels folded into recesses in the wings, and the other, extended for landing.

AS A VARIATION from the commercial planes that have been described in so many previous articles of this series, a simplified model of a military plane is illustrated this month. It is the Consolidated A-11, two-place attack plane. The last fighting plane used in the series was the Boeing P-26 A pursuit ship (P.S.M., Apr. '35, p. 74).

This new, trim-looking fighting ship has retractable wheels that fold up into the wings and is capable of flying 227 m.p.h. The wing span is 43 ft. 10 in.; length, 29 ft. 3 in.; height, 8 ft. 4 in. The model is built to our usual scale of $\frac{3}{8}$ in. equals 1 ft.

The drawings and photographs show a simple method of holding



Working plans with sizes of principal parts indicated and a scale for finding other dimensions

the wheels in lowered and raised positions. A common pin, which is pushed down through a hole in the wing and into the end of the strut, holds the strut in the corner of the wheel pocket. This is the landing position. To change the wheel to the flying position, pull the gear off the pin, remove the pin, push the wheel into the pocket, and fasten by inserting a short pin into the strut and wing.

In the actual plane, the wing is a one-piece structure. Since this is difficult to make in a model because of the dihedral, part of the under portion of the body should be painted yellow to match the wings and give the effect of a single wing. Horizontal tail and fin are also yellow; fuselage, struts, wheels, and hood, olive; cockpit, cowl openings, tires, and trim, black. Red, white, and blue decorations are used as shown.

If the model is mounted on the end of a stiff wire set into a block base, with the landing gear raised, it will have a realistic appearance and should make an unusually interesting ornament for living room, den, or boy's room.



The parts ready for assembly. For convenience, the wing is constructed in two pieces

USING A DRILL PRESS FOR WOOD TURNING

IN THE absence of a lathe, faceplate work such as wooden pulleys and jar covers may be turned out quickly and satisfactorily on an ordinary drill press. If a shaper-cutter spindle is available, mount the piece to be turned by boring a hole in the wood and locking in place. To use a regular chuck, mount the piece on a headless bolt and clamp in the jaws. Place a washer between the wood and the jaws to give a better grip and to avoid denting the wood.

For edge cutting, clamp a block of wood to the table and use it as a tool rest. For surface cutting, swing the table to one side and use its edge as a rest. Ordinary wood chisels may be used as tools.

If the hole is not needed in the finished work, it may be plugged. For ornamental work, the plug may be of a contrasting color or made in the shape of a knob, enhancing the design.—ALEXANDER MAXWELL.



An improvised set-up for turning a wooden jar cover. The chisel rests on a small block

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AND HERE'S THE FREE
BOOK THAT BRINGS
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ON DECORATION

"Designs for Living"—a decorator's handbook of 38 pages, beautifully illustrated, was prepared by the Studio of Creative Design. It tells how to arrange furniture—select proper colors—the part glass plays in decoration. Gives suggested decorative plans, room by room—hall, living-room, dining-room, bedroom, bathroom, kitchen. Contains ideas for painted furniture—and a section is devoted to modernizing exteriors. Send the coupon below for your copy.

Four fast-drying Pittsburgh Paint Products have revolutionized methods of decorating interiors, eliminated endless days of muss. With Wallhide, Florhide, Waterspar Enamel and Waterspar Varnish, painters begin in the morning—walls, ceiling, floor and trim are fresh, bright, dry and ready for use that night. Look under "Paints" in classified telephone directory for nearest Pittsburgh Paint dealer. If you wish, he will recommend a reliable painter.

WALLHIDE—for walls and ceilings

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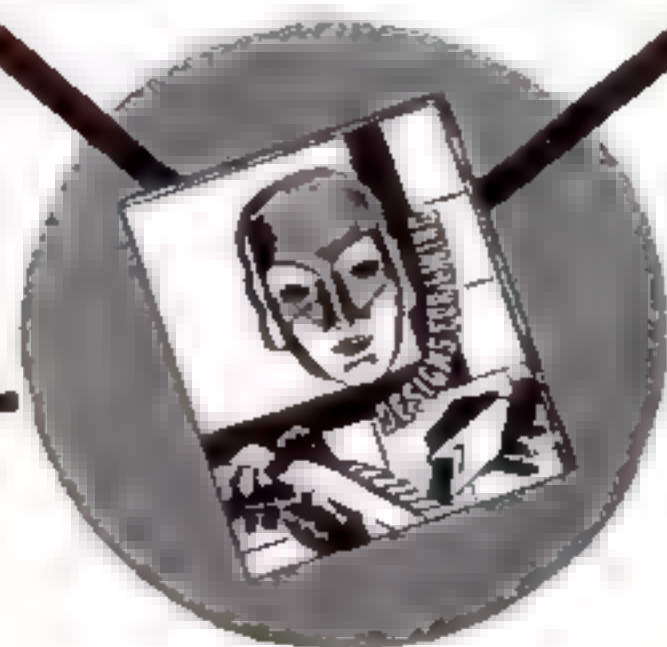
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*Let me tell you
about my
Operation*



● People tell me that I look better than I ever have in my life . . . and I surely feel better. Those artists, designers and tool makers who fussed over me for months were certainly pleased.

My face is full and well-rounded. My temper is improved. And I feel better balanced with that heavy feeling all gone.

I have a much better grip on things . . . especially small, headless brads.

My neck is slim and supple now. And my new handle has a comfortable, shaped grip, and a flared end to keep me from slipping.

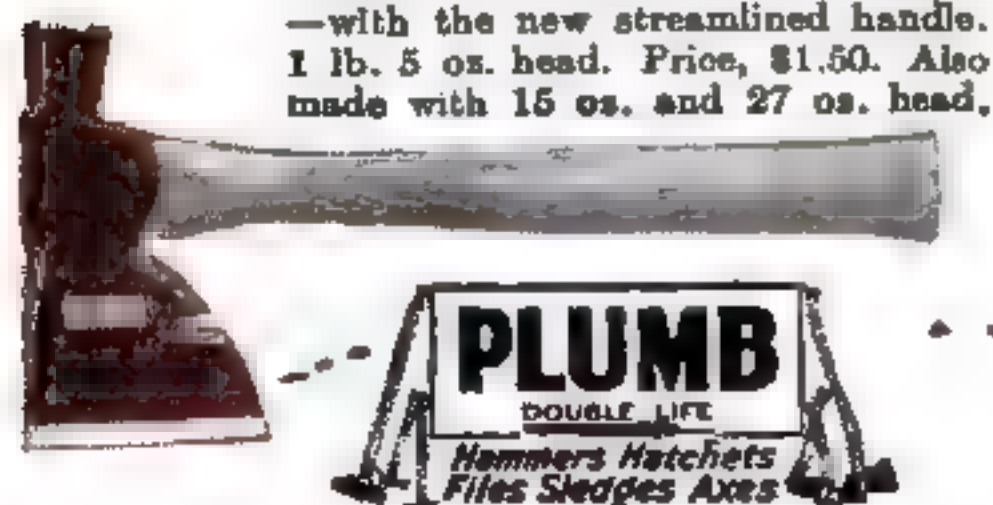
I'm looking for work now... a place on any work-bench will be fine. I can promise a lifetime of faithful service. I can promise never to fly off the handle. (My patented Take-Up Wedge prevents that!)

Stop in and see me at your nearest hardware store.

The new Plumb Nail Hammer HF 81 is \$1.15. Look for the Red Handle and Black Head.

FAYETTE R. PLUMB, Inc., Phila., U.S.A.

PLUMB HALF HATCHET No. 2962
—with the new streamlined handle.
1 lb. 5 oz. head. Price, \$1.50. Also
made with 15 oz. and 27 oz. head.



THE LAST FRONTIER OF AVIATION

(Continued from page 33)

when the three and a half acres of fabric in their balloon *Explorer* was torn to pieces in the air over Nebraska.

Its successor, *Explorer II*, the largest balloon ever constructed by man, held 3,700,000 cubic feet of gas. It carried Stevens and Anderson to a height of 72,395 feet, 13.7 miles, on November 10, 1935. This record skyride started from a cliff-encircled natural bowl in the Black Hills of South Dakota and lasted eight hours and thirteen minutes. The landing, near White Lake, S. D., was so gentle that the ton of delicate instruments the balloon carried reached the laboratories in perfect condition. The story told by these robot observers added to the conviction of aerial experts that the superhighways of the air will be found above the storms and clouds of lower levels.

BEFORE this can be accomplished, however, numerous engineering problems must be solved. Difficulties bar the way to the stratosphere. But none of them appear insurmountable.

At the peak of his flight, Stevens noticed that an electric propeller, attached to the outside of the gondola to turn it and keep one side from being overheated by the sun's rays, was spinning at 5,000 revolutions a minute, while the gondola was not moving an inch. The blades could not grip the thin air. Similarly, airplane propellers suitable for sea-level work would be useless at 40,000 feet. The answer seems to be blades that can be changed to take a greater "bite" as the plane ascends. Such adjustable-pitch propellers are already on the market.

Then, there is the problem of maintaining engine efficiency. As a gasoline motor reaches higher altitudes, its power decreases; at 30,000 feet it is only a fraction as powerful as it is at sea-level. Superchargers, maintaining sea-level pressure at any height, may be the solution. Or, steam engines, just as efficient high in the air as on the ground, may power the stratosphere ships of the future.

To safeguard the lives of passengers against the intense cold, the lack of oxygen, and the near-vacuum of the upper reaches, stratosphere ships will have to resemble submarines with wings. Their reinforced cabins will be air-tight and heated; automatic mechanisms will maintain internal pressure, keep the oxygen content of the air up to normal, and remove carbon dioxide and moisture from the artificial atmosphere. Most of the world's population lives below 3,000 feet, and fully half of the life-sustaining air in our atmosphere is below 20,000 feet. So, ships that climb to the upper air lanes will have to take their oxygen and air pressure with them.

HOWEVER, this same thin air which challenges human life will help make time tables of the present read like those of a prairie stagecoach. With air resistance reduced a hundred times, high-altitude planes can set and keep a pace which engineers estimate may exceed 500 miles an hour. At that speed, you could fly 12,000 miles, half around the earth at the equator, in a single day; you could streak across the continent or fly the Atlantic in six hours—between breakfast and lunch!

With air lines climbing the stairs to higher levels, such flights may lie in the very near future. Here is the trip from New York to Paris as present-day engineers vision it in the future.

You climb aboard the Stratosphere Express at a Long Island airport. The great plane is far larger than those now in use. Piercing each side of its body is a row of round, double-glass windows, specially designed to prevent fogging. Behind you, the steward is bolting

the door as though it were the water-tight hatch of a submarine. The roar of the giant engines becomes a faint whisper in the sound-proofed cabin. Through the windows, you see the asphalt runway streak to the rear and then fall away. You are off for the stratosphere.

At more than 1,000 feet a minute, you mount on a long slant to the northeast. There is not a cloud in the sky, and the horizon pushes back farther and farther as you climb. At the front of the cabin, you see the hand of a huge altimeter, as big as a schoolroom clock, swing past the 5,000, the 8,000, the 10,000-foot mark. At 10,000 feet the cabin is completely sealed up and air compressors run by little windmills on the leading edge of the wings, begin building up pressure inside.

YOU notice a curious thing. There is little sensation of rapid ascent. On an ordinary airliner, a change of 300 feet a minute, up or down, is about all that passengers can stand in comfort. Here, with no change in atmospheric pressure in the cabin, the ship may climb and descend as rapidly as it is able. This saves time getting to and from the stratosphere.

Boston, Mass., and Portland, Me., pass beneath you before you reach the 35,000-foot level, and by the time you are at 40,000 feet and ready for the transatlantic hop to Europe, the tongue of southern Nova Scotia lies below.

You look out of the windows and gasp at the eerie sight you see. The sky is deep blue-black and the intensity of the sunlight makes the wings seem to glow and appear larger than they are. Below, you can see for 200 miles in any direction, with only here and there a cloud obscuring the view. All around the horizon, you see a whitish band of haze. Above it, a wide strip of light blue deepens and shades into the dark violet of the zenith. In spite of the blinding glare of the sun, stars are visible, shining at the top of the sky.

Ahead, over Newfoundland, cloud banks form a vast floor, gleaming like snowy cotton batting in the sunshine. With nothing visible as a landmark by which to gauge your speed, you seem to be standing still. Only the glint of the great, four-bladed steel propellers and the far-away murmur of the engines tell you that you are hurtling along the trail Lindbergh followed at fully five times the pace set by the *Spirit of St. Louis*. You will reach Europe in a sixth the time taken by the huge Zeppelin, *Hindenburg*.

In the stratosphere, the throttle can be set in one position and never moved until the goal is reached. There is no zigzagging to avoid storms; no blind flying; no strain of battling gusts. You settle back on leather cushions and open the morning paper. As snug and comfortable as though you were home, you read the news while the Atlantic flows past far below. Through breaks in the clouds, you catch an occasional glimpse of a passing vessel or the peak of a drifting iceberg. You see no birds. The stratosphere plane has mounted beyond the reach of feathered wings.

IT TAKES you only a little more than three hours to bridge the rolling waters of the Atlantic from Harbor Grace, Newfoundland, to the green western tip of Ireland. The clouds close in over England, then open again above the channel with its tiny elongated specks that are steamers. In 1909, it took Louis Bleriot half an hour to cross that twenty-one-mile strip of water, riding a monoplane pulled by a sputtering three-cylinder engine. You shoot through the air like a rocket, covering the same distance in less than three minutes! (Continued on page 87)

THE LAST FRONTIER OF AVIATION

(Continued from page 86)

Over the coast of France, you begin the thrilling 250-mile down-hill slide to Le Bourget, the airport at Paris. Sitting relaxed in your easy chair, you have no sensation of plunging downward through the sky at upwards of ten miles a minute. As the hand on the altimeter swings past the 10,000-foot mark, the compressors go off, vents are opened, and you once more are breathing normal atmosphere. The drop becomes more gentle now. Gradually, the ship circles lower, swings high over Paris, heads back into the wind, and slips in for a gentle landing at the air terminal of the French capital.

BECAUSE of the difference in time, the clocks of Paris point to half past four in the afternoon. You started at five in the morning and arrived after six and a half hours of flying, but, Paris time is five hours later than New York time. Going back, however, you will gain five hours owing to the difference in time, and you will arrive in New York, 3,600 miles away, one hour and a half, by the clock, after you start!

Before you leave Le Bourget, you purchase your return ticket. You can make reservations for the stratosphere planes weeks ahead any day of the month. Above the realm of weather, they run on schedule undelayed by winds and storms. Only in landing and in taking off are the big ships affected by blizzards and fogs. And, with special radio guides, they can come in or take off in any weather, rising or descending rapidly through the "weather zone" which blankets the earth.

High above this zone, military men expect aerial battles of the future to be fought. Already, Italy has established a stratosphere flying school and the French Air Ministry is cooperating with civilian designers in working out plans for thin-air fighting ships. Because of the vulnerability of air-tight cabins—a single bullet would produce a fatal leak—pilots who dog-fight in the stratosphere probably will wear individual pressure suits and oxygen masks such as were tested by the late Wiley Post. They will look like deep-sea divers riding 500-mile-an-hour planes across a blue-black sky.

METEOROLOGISTS now visualize the atmosphere surrounding the earth as a series of layers, like the cross section of a baseball, the earth representing the core. Above the stratosphere lies the zone of meteor activity. Then comes the Kennelly-Heaviside layer, the electrified blanket which reflects radio waves and enables them to circle the globe. Above that is the layer of ozone which absorbs most of the ultra-violet rays from the sun and makes life possible on the planet below. At the top of the atmosphere is the home of the vast, mysterious electrical display known as the aurora.

Some day, man-carrying rockets may leave the stratosphere behind and plumb the outer depths of these succeeding layers. For the present, however, science is most concerned with conquering the thin-air area less than a dozen miles above the earth. It is convinced that the future of aviation lies "upstairs" in the stratosphere.

SOFT COAL IS WAXED TO PREVENT DUST

WAXING soft coal by a recently developed process prevents the formation of dust and makes the bituminous fuel as clean as the hard coal used in home furnaces. The soft coal is coated with a layer of petrolatum, a paraffin by-product of oil refining. In tests, no dust formed on samples of the waxed fuel stored in bins for more than two years.

HALF & HALF MAKES ONE SWELL SMOKE!



No Bite!



No Bite!



Still no Bite!

Give your pipe a new start in life, with Half & Half. Cool as a doctor's "Open your shirt." Sweet as his words: "Your heart's ticking fine!" Fragrant, full-bodied tobacco that won't bite the tongue—in a tin that won't bite the fingers. Made by our exclusive modern process including patent No. 1,770,920. Smells good. Makes your pipe welcome anywhere. Tastes good. Your password to pleasure!

Not a bit of bite in the tobacco or the Telescope Tin, which gets smaller and smaller as you use-up the tobacco. No bitten fingers as you reach for a load, even the last one.

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HALF ^{AND} HALF
The Safe Pipe-Tobacco
FOR PIPE OR CIGARETTE

DISSTON

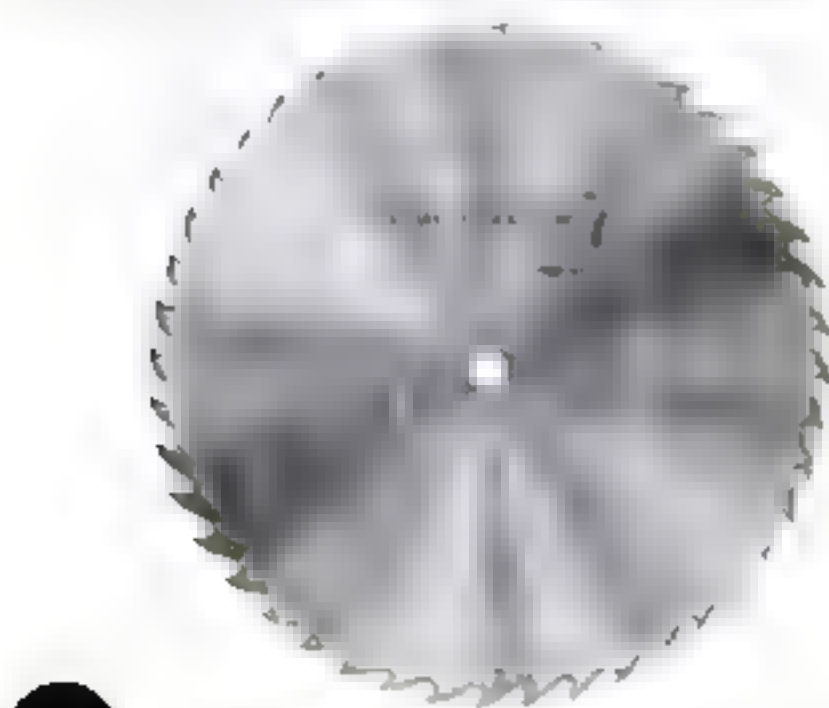
MAKES THE SAW to buy for your machine



In Disston De Luxe Home Workshop Saws, you get Disston steel and Disston workmanship, of the same world-known standards, same guarantee, as the famous Disston Circular Saws used by the great lumber mills. You will take lasting satisfaction and pride in ownership of a Disston De Luxe — the finest blade made.

De Luxe Cross-Cut — Rip — Combination
 6" (1/2" hole), \$2.40 8" (1/2" 5/8" 3/4" hole), \$3.20
 7" (1/2" hole), \$2.80 10" (5/8" 3/4" hole) . . . \$4.05

De Luxe Hollow Ground Combination
 6" (1/2" hole), \$3.25 8" (1/2" 5/8" 3/4" hole), \$4.90
 7" (1/2" hole), \$4.40 10" (5/8" 3/4" hole) . . . \$6.20



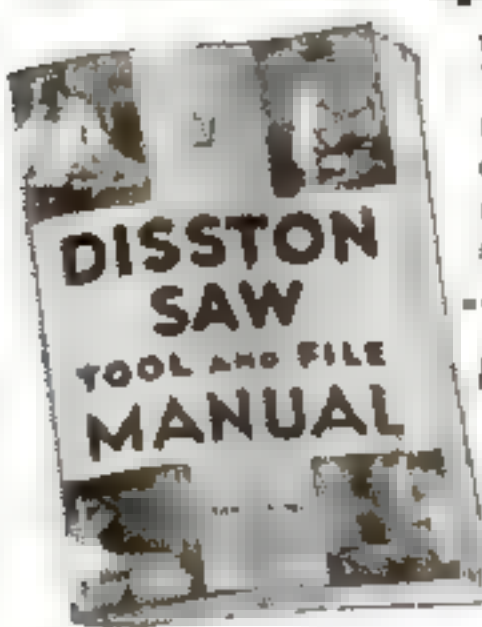
ALSO,—your dealer has amazing values, at \$1.20 to \$2.00, in Keystone Disston-made Circular Saws! Ask to see these Keystone Saws, made by the world's foremost sawmakers. They will give you good service in your home workshop.

Keystone Cross-Cut — Rip — Combination
 6" (1/2" hole), \$1.20 8" (1/2" 5/8" 3/4" hole), \$1.60
 7" (1/2" hole), \$1.40 10" (5/8" 3/4" hole) . . . \$2.00

Keystone Hollow Ground Combination
 6" (1/2" hole), \$3.00 8" (1/2" 5/8" 3/4" hole), \$4.00
 7" (1/2" hole), \$3.50 10" (5/8" 3/4" hole) . . . \$5.00

In Canada, prices slightly higher

To Give Work Speed and Accuracy



use Disston Saws, Tools, Files, in your home workshop. How to choose, use, care for, these fine tools, is shown in this Disston Manual, sent **FREE**

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ARTISTIC LAMP SHADES CUT FROM VENEER



Shade covered with wood veneer after being reinforced with cellulose wrapping material

WOOD veneer that is irregular in grain and contains whorls and other odd figures is excellent material for making artistic lamp shades. Sometimes a supply of discarded veneer of this type can be obtained from furniture factories at considerable saving over the cost of new veneer. Walnut, myrtle, and maple form the best shades, and the thinner the veneer, the better. Pieces should be selected so that the grain follows a definite pattern around the shade.

Choose the style of shade you wish to make, then cut out a paper pattern and fold it to shape to make certain it is correct. Place the template on the veneer, keeping the grain in mind, and with sharp shears or knife, cut the veneer 1 in. larger all around than the pattern.

Cover a smooth board or piece of plywood with wax paper and lay the veneer upon it. Apply a thin coat of quick-drying varnish, cover with a sheet of transparent cellulose wrapping material, and work out all air bubbles. Place wax paper on the surface and weigh it down with another smooth board and a flat iron or several bricks. Allow the varnish to dry for about twenty-four hours; then cover the other side of the material in the same way.

Pleasing effects may be obtained by using colored cellulose sheets, but it is well to experiment first as the material will look different under artificial light from the way it appears in daylight. Let the material dry for at least two days.

The next step is to make a frame for the shade, using either iron or brass wire about 1/8 in. in diameter. It is best to weld the frame, using iron wire, but if soldering is to be used, then make the frame of brass wire.

Take the template and fit it to the frame, just as if it were the shade material. If the shade is flat, trim the template to 1/8 in. larger all around than the frame. Draw a line 1/2 in. from the edge of the template and with a leather punch, (Continued on page 89)



Lamp cluster assembled from common fittings, and a round shade as it appears from above



Front view of a wall shade made of veneer

DOUBLE A Power TOOLS

10 IN. JIG SAW \$1.79

The Champion American Jig Saw is a real power tool. It is built for hard use. It is the only jig saw that has a 2 inch stock. Takes 8 inch saw blade. Strong vise, accurate gears. Firm cast iron frame. Accurately machined for true cutting. Recommended speed, 125-150 strokes per minute. 1/2 or 3/4 inch. Shipping wt. 20 lb. Price, \$8.95, prepaid east of Rockies. Stock carrier, to steady stock from rear, 50c extra.



WOODWORKER'S VISE ——— \$1.39

Strong, rugged, practical. Carefully and accurately finished. Jaws, 6 by 2 1/2 inches. Open to 6 inches. Shipping wt. 8 lb. Price, only \$1.39, prepaid east of Rockies.



MOTOR-DRIVEN HACK SAW — \$8.95

The new portable Pioneer is sturdy, built for hard use. Needed in every shop and garage. Cuts 2 inch stock. Takes 8 inch saw blade. Strong vise, accurate gears. Firm cast iron frame. Accurately machined for true cutting. Recommended speed, 125-150 strokes per minute. 1/2 or 3/4 inch. Shipping wt. 20 lb. Price, \$8.95, prepaid east of Rockies. Stock carrier, to steady stock from rear, 50c extra.



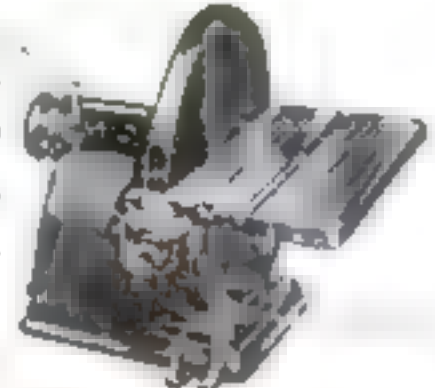
METAL LATHE — \$10.95

1936 model, longitudinal feed, heavy duty, 8 by 18 inches for precision turning. Hollow spindles. Offset bronze bearing headstock. Sturdy cast-iron No. 9 frame. 600 centers. 20-inch bed. 4-step pulley. Accurately fitted and machined. Easily converted to wood turning lathe. Shipping wt. 27 lb. Price \$10.95, prepaid east of Rockies. Extra, 4 Step Pulley, for motor or line shaft, 75c extra, 8-in. 4-Jaw Independent Chuck, \$4.50 extra.



DISC SANDER — \$1.50

A Double A feature an Asset and an Advantage to the workshop. Absolutely unique! Nothing like it at so low a price! 11 1/2 by 14 1/2 by 6 1/2 inch sanding plate. Overall height 7 1/2 inch. Depth 8 1/2 inch. Length 8 1/2 inch. Shipping weight, 8 lb. Price, prepaid, \$1.50, east of Rockies. Package of 6 assorted sanding discs, 30c extra.



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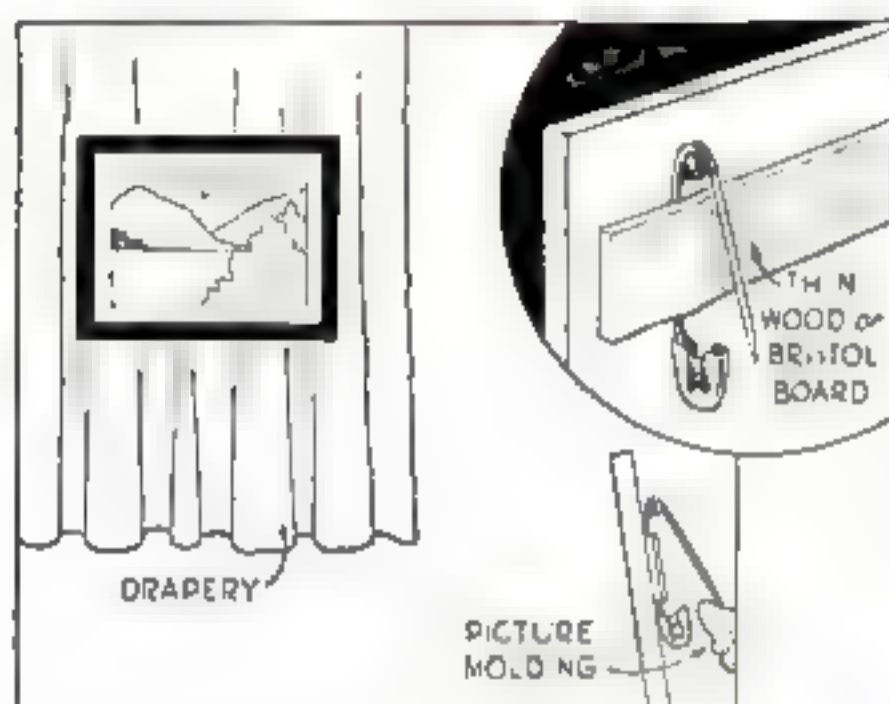
(Continued from page 88)

punch small holes every $\frac{1}{2}$ in. If the shade is round, use the same method but allow $\frac{1}{2}$ in. on each edge where the edges lap. Stitch the template to the frame to make certain it fits properly. Then cut the prepared veneer to the exact size and punch corresponding holes in it.

The final step is to sew the material to the frame. Raffia is sometimes used, but rayon cord about the size of common store twine is preferable. Any uniform stitch is satisfactory. In order to keep the shade from being drawn out of shape, start at any one place and go completely around with one stitch; then go back several times until the holes are filled.

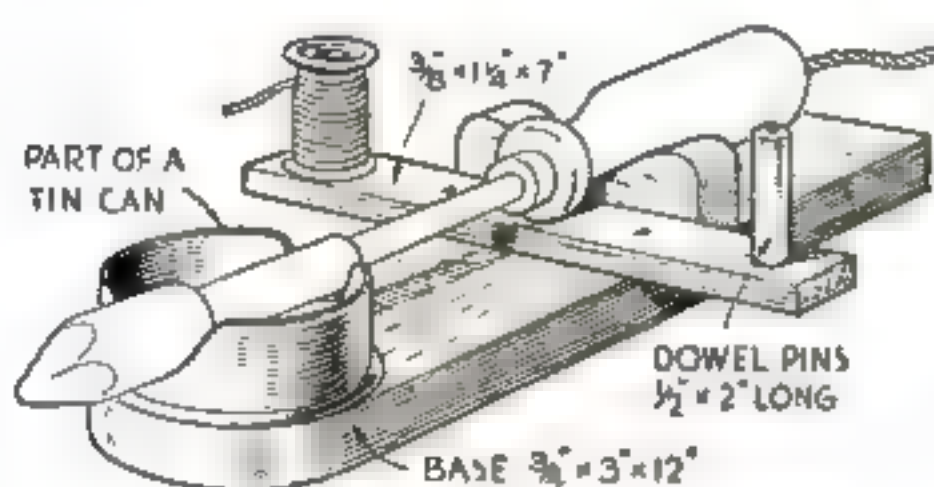
Make certain that the lamps are placed so that the heat generated can escape freely or the shade may warp. Depth can be added to the shade by thinning oil colors with gasoline and applying to the raw veneer with a piece of lintless cloth.—W. C. CHENEY.

MOUNTED PICTURES HUNG WITH SAFETY PINS



PICTURES, posters, signs, and mounted drawings may be quickly and securely hung on draperies, wall-board display panels, the temporary walls of exhibition booths, and the like, by means of safety pins fastened as shown. A strip of thin wood or heavy Bristol board glued to the back of the picture holds the pins in place. Two pins will hold sizes up to 18 by 24 in., while three or more pins should be used for larger sizes. The pins can be closed when pictures are being carried or shipped.—H. W. DRYDEN.

COMPACT OUTFIT SAVES TIME WHEN SOLDERING



A CONVENIENT and inexpensive soldering stand may be made as shown above. No time is wasted looking for the solder because two spools, one of rosin-core and the other of acid-core solder, are kept on pegs beside the handle of the electric soldering iron, well away from the heat. The iron rests on metal, preventing fire hazard.—CECIL FORD.

BROKEN CHINA AND GLASS HELD IN SAND FOR CEMENTING

WHEN mending broken china or glass, lay the cemented parts in a box partly filled with sand so that they will stay in position until the cement has hardened.—K. M.

THREE MUSKETEERS

ATHOS — PORTHOS — ARAMIS

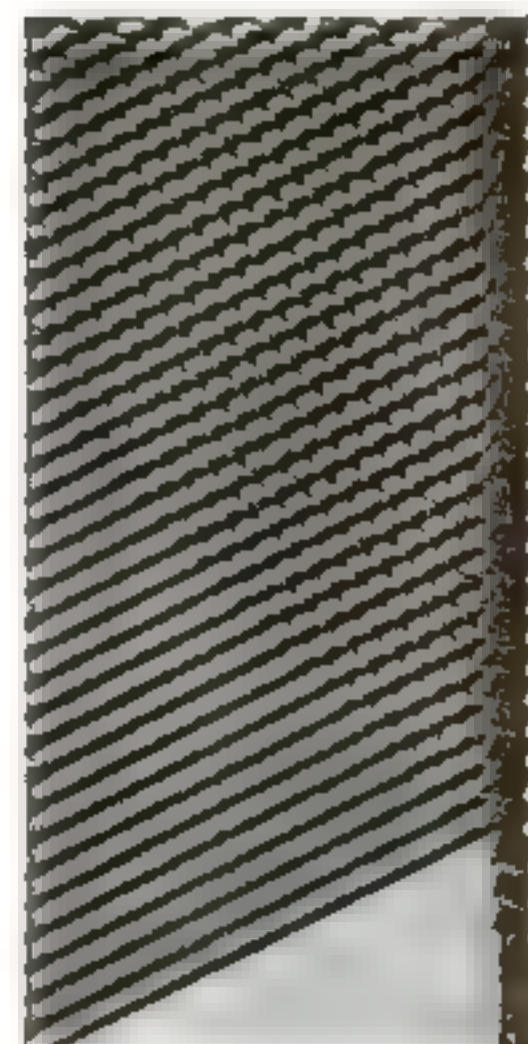


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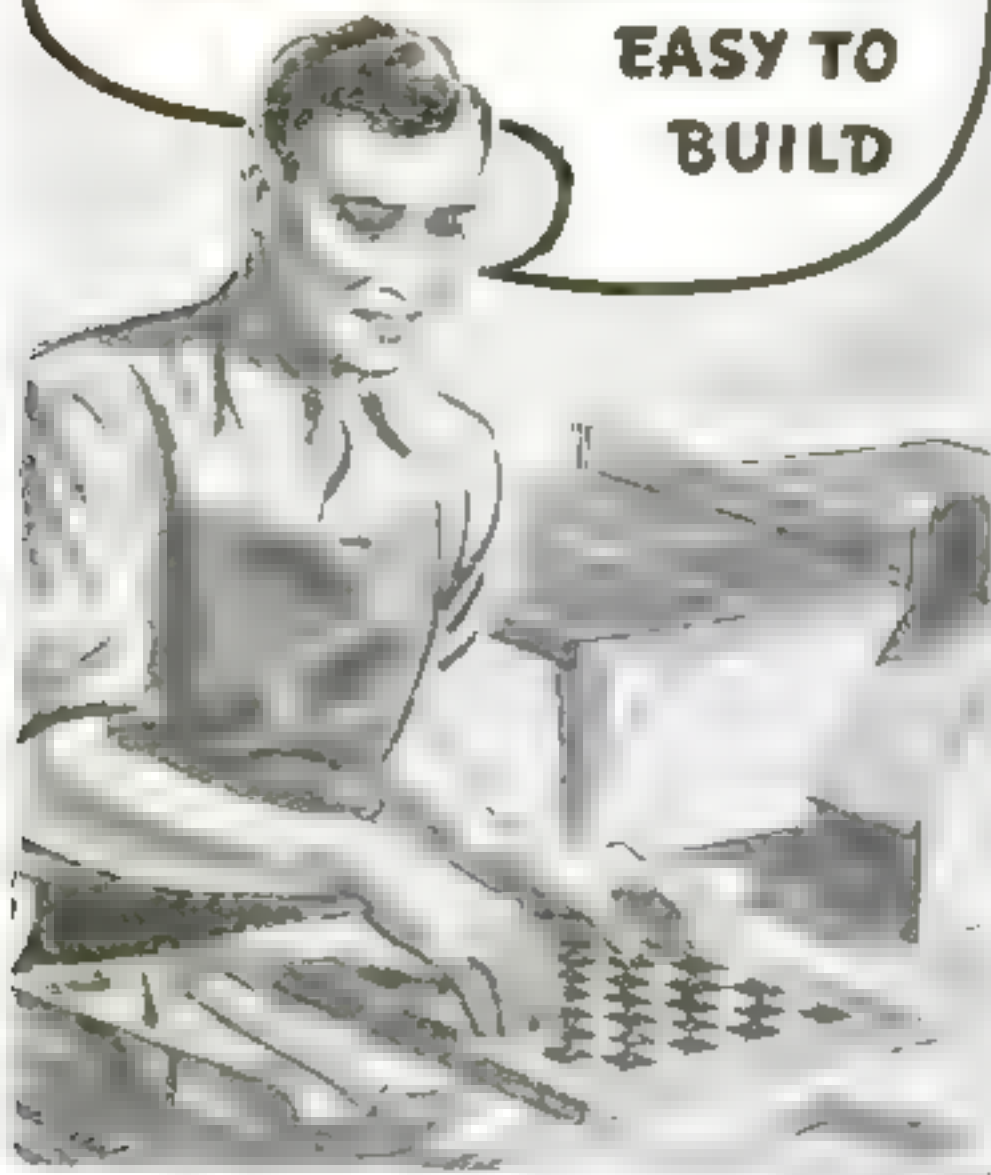
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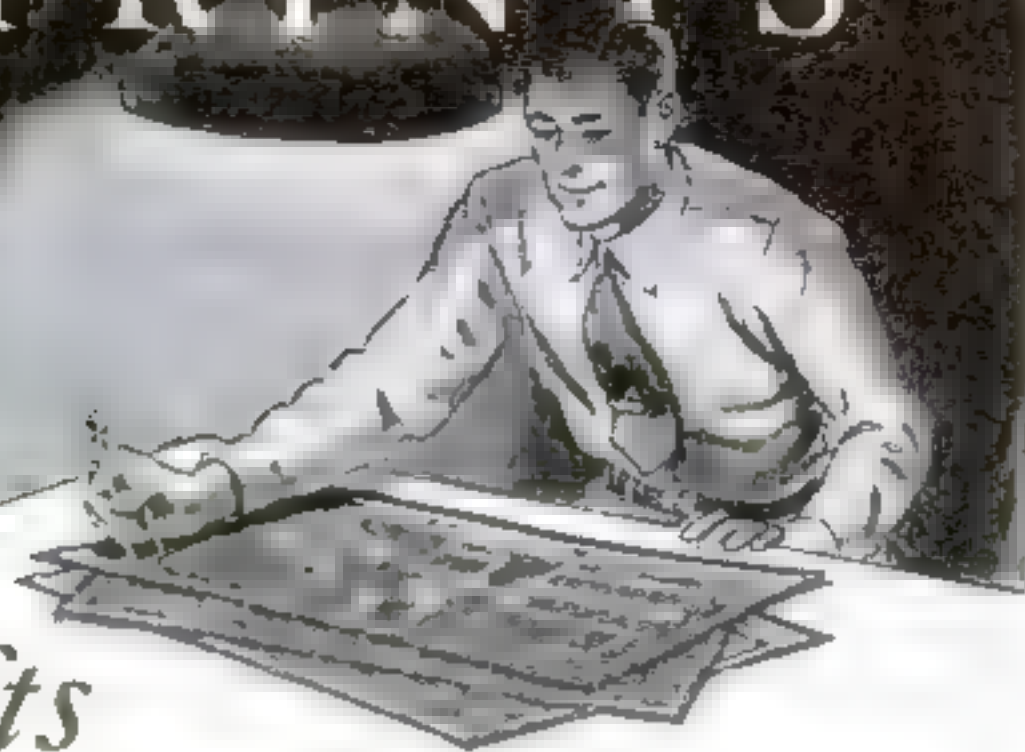
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The following subjects are a selection of the most popular blueprints we have been printing since 1922. If you do not see what you want, send a self-addressed, stamped envelope for our complete list.



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Bookcase (with doors, but simple to construct), 37	.25
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Floor Lamp with Tripod Base, 243A	.25
Gate-Leg Table with Round Top, 24	.25
Hanging Wall Cabinet, Colonial, 280A	.25
Lamps, Three Modern, 93	.25
Magazine Rack, Ladder-Back Style, 250A	.25
Modernistic Book Ends, Low Stand, and Bookshelf, 100	.25
Pier Cabinet, 77	.25
Sewing Cabinets, Two, 31	.25
Smoking Stand, Modern, 238A	.25
Stool, Scoop-Seat, 242A	.25
Stool, Upholstered, 240A	.25
Table, Four-Leaf Card, 239A	.25
Tables, Tile-Top, 249A	.25
Treasure Chests (metal bindings), 78	.25
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MODELS

Aircraft Carrier <i>Saratoga</i> (18-in.) and Flush-Deck Destroyer, 226-227-R	.75
Airplane Racing Model, Twin Pusher (35-in. wing spread), 86	.25
Battleship <i>Texas</i> (3-ft. hull), 197-198-199-200	1.00
<i>Bluenose</i> , Famous Fishing Schooner (17½-in. hull), 110-111-112-R	1.00
Clipper Ship <i>Great Republic</i> (31½-in. hull), 272-273-274-R	1.25
Clipper Ship <i>Sovereign of the Seas</i> (20½-in. hull), 51-52-53-R	1.00
Clipper Ship in a Bottle, 121-122	.50
Coast Guard Patrol Boat (20½-in.), 286-287-R	.75
<i>Constitution</i> (21-in. hull), 57-58-59-R	1.00
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<i>Galleon Revenge</i> (25-in.), 206-207-208-209	1.00
H. M. S. <i>Bounty</i> (8½-in. hull), 254	.25
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Miniature Coach and Covered Wagon, for decorating boxes, etc., 202-R	.50
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<i>Nourmahal</i> , power yacht (8½-in.), 276	.25
Liner— <i>Normandie</i> (20½-in.), 264-265	.50
Liner— <i>Queen Mary</i> (10¼-in.), 283	.25
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Privateer of 1812— <i>Swallow</i> , a Baltimore clipper (13-in. hull), 228-229-230-R	1.00
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Scenic Half-Model of a Barque (13½ in.), 108	.25
Seaplane, Tractor Model (30-in. wing spread), 87	.25

<i>Sea Witch</i> , Clipper Ship (9¼-in. hull), 219	.25
Spanish Treasure Galleon (24-in.), 46-47	.50
Steamboat, <i>Mississippi</i> (19¼-in.), 94-95-96-R	1.00
Trading Schooner (17½-in. hull), 252-253	.50
Tugboat, Harbor (11¾-in.), 284	.25
Tugboat, Water-Line (5 3/16-in.) and Barge (7 3/16-in.), 285	.25
U. S. Destroyer <i>Preston</i> (31¼-in.), 125-126-127-R	1.00
Viking Ship (20¼-in.), 61-62-R	.75
Whaler— <i>Wanderer</i> (20½-in.), 151 to 154	1.00
<i>Winnie Mae</i> , 4-ft. Flying Scale Model, 141-142-143	.75
<i>Yacht Rainbow</i> (7½-in. hull), 233	.25

(Construction kits are available for some of these models. See page 8.)



RADIO SETS

All-Wave Portable Receiver (two tubes, operated by battery), 217-R	.50
Amateur Short Wave Receiver, 155	.25
Amateur Radio Transmitter, 183-184	.50
Five-Tube Short Wave (A.C. or D.C.), 223	.25
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Acrobatic Monkeys Toy, One-Legged Table, and a Hat and Coat Rack, 248	.25
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Perpetual Star Chart, 214	.25
Projector for Photos and Pictures, 259A	.25
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Toy Drill Press, Lathe, Saw, etc., 113	.25
Toy Dump Truck, Fire Engine, etc., 101	.25



BOATS

Canoe, 16-ft. Canvas-Covered Kayak, with sail, etc., 192-193-194-R	1.00
Combination Boat, 15-ft., for sail, outboard motor, or oars, 131-132-133-R	1.00
Duck Boat, Folding (13-ft.), 170-R	.50
High-Speed Boat for Small Outboard Motors (7 ft. 11 in. long), 257	.25
13-ft. Motorboat-Rowboat (has decked hull; for use with outboard or inboard drives and oars), 147-R	.50

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Old
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SAYS:

ON THE inside of the cover of every tool-post grinder case, a notice should be stuck, reading something on this order: 1—Select the proper grinding wheel. 2—Choose the correct pulleys for wheel speed. 3—Stand aside when starting.

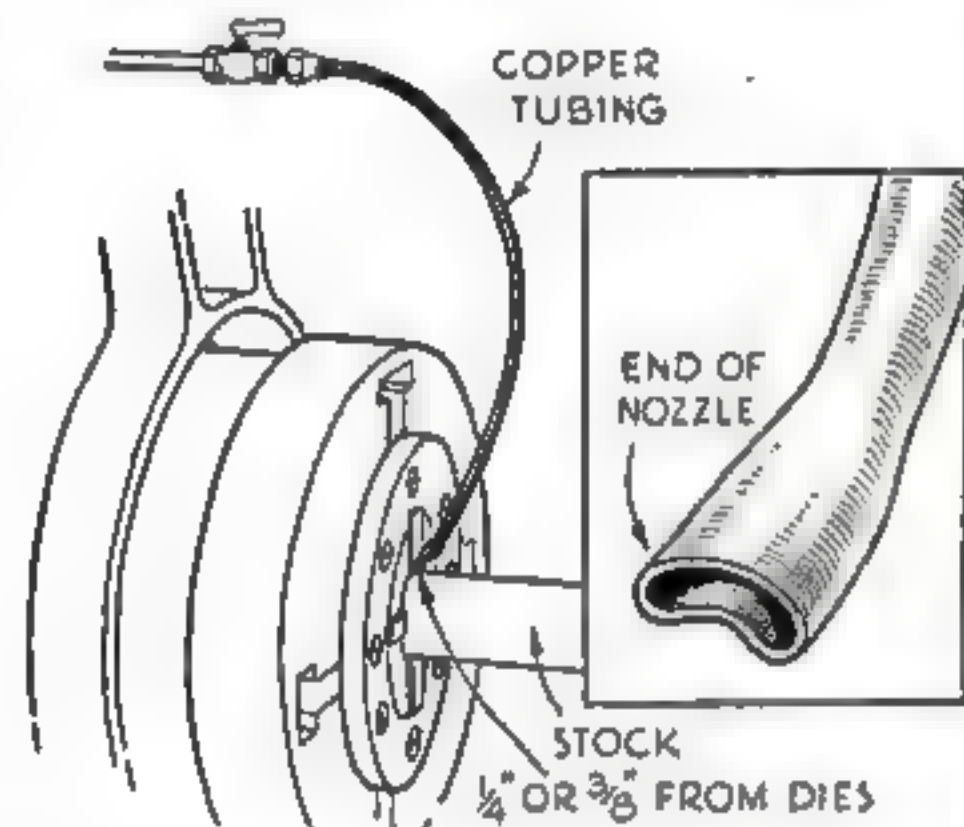
A milling cutter will last much longer between grinds if the sharpening is finished by taking a light cut with a wheel that has been freshly dressed with a diamond tool. Then, if the cutting edges are afterwards oilstoned, the tool will stay sharp still longer.

When a forming tool or a die comes from the hardening room, it should be given a bright polish before any grinding is attempted. Inspect it closely with a strong magnifying glass or, better still, a shop microscope for any possible cracks.

Don't take it for granted the mechanic who preceded you at the tool-room surface grinder was careful enough to oil it up. Better do it yourself.

An expansion reamer can't be trusted for accurate work deeper than $\frac{1}{2}$ in. if it has been in use for some time. Play safe and use an adjustable type reamer if there's one handy.

EFFICIENT OIL NOZZLE FOR BOLT CUTTER



INSUFFICIENT lubrication of the work being threaded on an ordinary bolt cutter often results in expensive dies wearing out quickly. This is because the flow of oil over the dies and work is incorrectly directed by the usual crude, straight nozzle. The sketch above shows a simple way of making a practical oil nozzle out of well-annealed copper tubing. The lower end of the pipe is flattened and curved slightly, and allowed to rest a short distance in front of the revolving dies. This throws the oil directly over the cutting contact, and the lubricant also washes away the chips. A piece of flat iron can be ground on a rough emery stone and used to shape the end of the tubing.—FRANK W. BENTLEY, JR.



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☐ No. 10 10c ☐ No. 11 10c
☐ No. 12 25c
☐ Workshop Catalog No. 15 Free
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No. 415-3A 9" swing by 3 led Workshop Bench Lathe with Horizontal Motor Drive, $\frac{1}{4}$ H.P. Reversing Motor, Switch and belt \$103²⁵ tension countershaft as shown above.

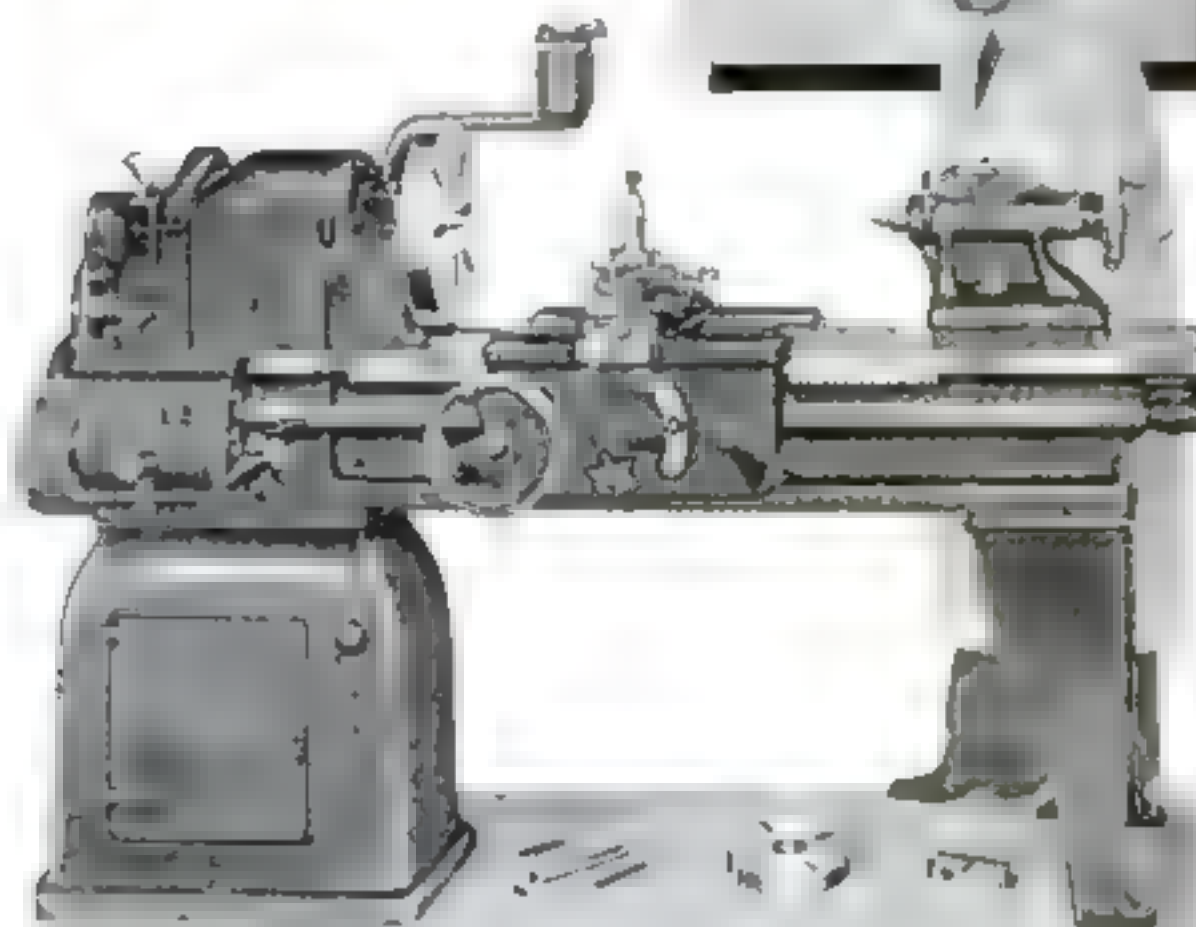
A PRECISION LATHE

The New 9-inch Workshop Lathe is a Precision Lathe with Twin Gear reverse to leadscrew, Ball Thrust Bearing on Spindle, Longitudinal Screw Feed to Carriage, Precision Lead Screw for cutting screw threads, and scores of other important features. Recommended for the finest work in the plant, shop, and tool room. Used by all important industries. Use coupon or write for complete details, free postpaid.

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Shown below No. 1-2 C 16" x 6" South Bend Quick Change Gear Underneath Bed Motor Driven Lathe with 3 phase motor, reversing switch complete assembly, weight 2,000 pounds \$779

5 OTHER SIZES
9"-11"-13"-15"-16" swing
in all bed lengths
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Scientists recently discovered that great numbers of people are thin and rundown for the single reason that they do not get enough digestion-strengthening Vitamin B and blood-enriching iron in their daily food. Now the richest known source of this marvelous body-building Vitamin B is cultured ale yeast. By a new process the finest imported cultured ale yeast is now concentrated 7 times—made 7 times more powerful. Then it is combined with 3 kinds of iron, pasteurized whole yeast and other valuable ingredients in little tablets known as Ironized Yeast tablets.

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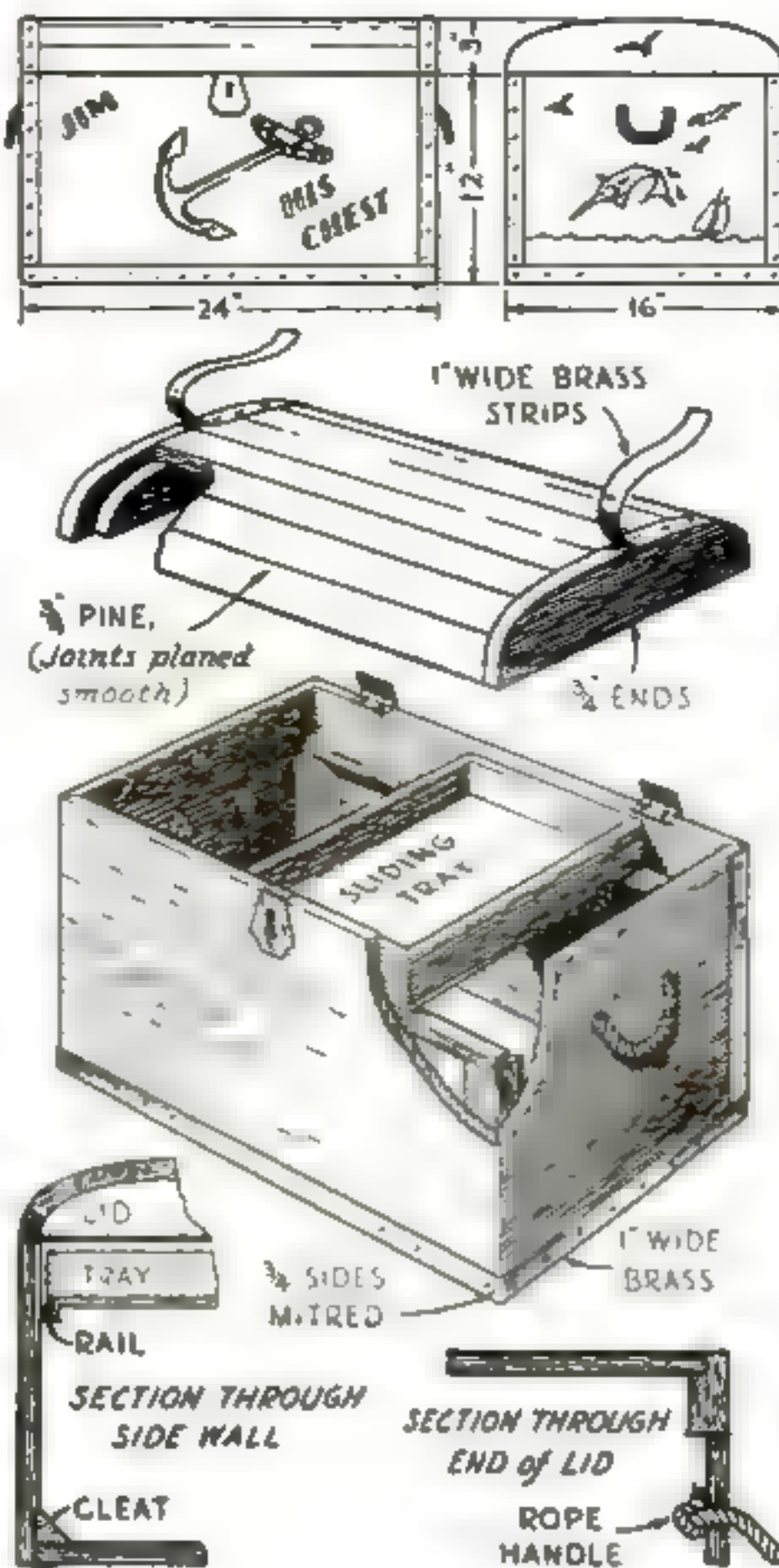
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No matter how skinny and rundown you may be from lack of enough Vitamin B and iron, try these new Ironized Yeast tablets just a short time. See if they don't build you up in a few weeks, as they have thousands. If not delighted with the benefits of the very first package, money back instantly.

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To start thousands building up their health right away, we make this absolutely FREE offer. Purchase a package of Ironized Yeast tablets at once, cut out the seal on the box and mail it to us with a clipping of this paragraph. We will send you a fascinating new book on health, "New Facts About Your Body." Remember, results with the very first package—or money refunded. At all druggists. Ironized Yeast Co., Inc., Dept. 4511, Atlanta, Ga.

SEAMAN'S CHEST HOLDS BOY'S BELONGINGS



THE construction of this seaman's chest for holding a boy's miscellaneous small belongings is a matter of simple carpentry. Briefly, it is a well-built box with mitered corners, bound with brass strap and having a lid similar to that of a so-called "Saratoga trunk." If you do not wish to bother with the brass binding, the straps can be painted on in black or rust color. A sliding tray is provided for holding small objects, and rope handles are placed at the ends.—**HI SIBLEY.**

A chest of this type is a useful and decorative piece of furniture for a boy's room, especially for a room furnished in nautical style (see P. S. M., Dec. '35, p. 64).

DOUBLE-SLOTTED CLOTHESPIN HOLDS COAT HANGER ON LINE

WHEN suits and coats are hung on a line outside for airing, the coat hangers have a tendency to slip up and down until the clothes are all hunched together, and in a high wind some of the hangers may swing far enough to fall off the line. Placing an ordinary wooden clothespin on each side of each hanger does not help much. The best solution is to slot several wooden clothespins with a saw in such a way that each has four prongs, instead of two. The regular slot is placed over the line in the usual way, and the new and narrower slot goes over the wire hook of the coat hanger, locking it securely in place. The hook cannot slide sideways nor swing with this arrangement.—**ETTA M. KIRBY.**

REMOVING A PIECE OF PIPE BROKEN OFF IN FITTING

A PIECE of pipe that breaks off just inside an ell or other pipe fitting may be removed by splitting the wall with a hack-saw blade (used without a frame) and bending the cut edges with a cold chisel so that the pipe will fall out. If care is taken, the threads will not be damaged.—**W. PHAIR.**

STOP! DON'T PUT ANTI-FREEZE IN A DIRTY RADIATOR!



WHEN you put anti-freeze in your car, you want it to stay in. Don't let a clogged radiator rob you! One cleaning with Sani-Flush (it costs a dime!) will last all winter. Sani-Flush removes rust, sediment and lime deposits that clog the delicate veins of a radiator. It's easy to use. It's safe.

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Sani-Flush **Safe**
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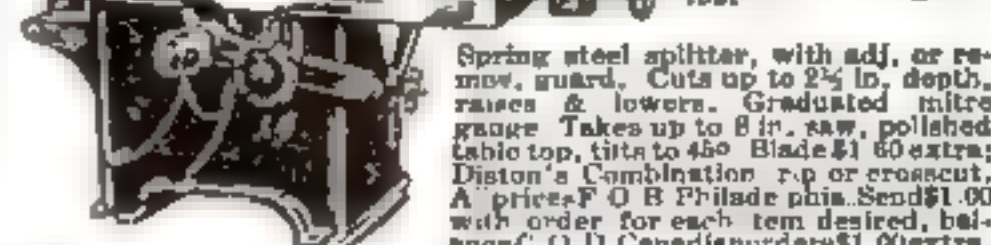
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Size 20" x 9" x 12". Sturdy, roomy, compact 8 drawers, handfilled, felt lined, steel runners, lock, nickel plated hardware. Ship. wt. 20 lbs.



Driver's DADO SAWS
Set of 8, 4 in. as illustrated 1/4 in. bore. Big bargain \$4.00 Value. Complete set **\$1.50**

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\$15 Value BENCH SAW
Size 12 in. x 14 in. Weight 28 lbs. Spring steel splitter, with adj. or remove guard. Cuts up to 2 1/2 in. depth, raises & lowers. Graduated mitre gauge. Takes up to 8 in. saw, polished table top, fits to 450 Blade \$1.60 extra; Dixon's Combination rip or crosscut. A price F O B Philadelphia. Send \$1.00 with order for each item desired, balance C. O. D. Canadian orders \$1.00 extra.

Send 10c for illus. catalog showing screw cutting lathes, drill presses and hundreds of other tools, etc.

MARTIN ELECTRIC T & S CO., 804 Arch Street Philadelphia, Pa.

SIMPLIFIED PLANS FOR A TANKER MODEL

(Continued from page 77)

attaching them to one another and the hull. Most pieces are already shaped when cut to the dimensions specified in the list of materials. Wherever possible, paint each piece before fastening it to another of a different color. For instance, do not attach the lifeboats to the deck of *H* until each has been painted its own color.

A distinguishing feature of an oil tanker is the catwalk that connects the superstructure aft with the bridge amidships. In our model, the walk is supported by the two pump houses *P* and *Q*, but to complete the effect of the trestle support along the deck, insert two rows of $\frac{1}{2}$ -in. pins into *B*. The distance between the rows should be slightly less than the width of *M*.

The various accessories and deck equipment are all easily prepared. The windlass is made by slipping two eyelets over a piece of wire to form the drum, and then fastening it to a small square of black cardboard. The hawse lips, too, are eyelets, as are all the portholes. The anchors can be cut from card or fiber, painted black, and glued in place. Short lengths of fine chain, such as used in cheap jewelry, add a realistic touch when stretched from windlass to hawse-pipe lips.

No special description is needed for the bridge and stern (Continued on page 94)

List of Materials

WHITE PINE, BASSWOOD, OR BALSA

No. of Pieces	T.	W.	L.	For
1	$\frac{3}{4}$	2	$13\frac{1}{4}$	A
1	$\frac{1}{2}$	2	14	B
1	$\frac{1}{4}$	2	1	C*
1	$\frac{1}{4}$	2	$3\frac{1}{2}$	D
1	$\frac{1}{4}$	2	$1\frac{1}{4}$	E
1	$1/16$	$\frac{3}{4}$	$3/16$	F
4	$1/16$	$\frac{3}{4}$	$\frac{1}{4}$	G
1	$\frac{1}{4}$	2	$2\frac{1}{8}$	H
1	$1/16$	$\frac{5}{8}$	$1\frac{1}{2}$	I*
1	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	J
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{5}{8}$	K*
2	$1/16$	$1/16$	$\frac{5}{8}$	L*
1	$1/16$	$\frac{1}{4}$	5	M*
2	$1/16$	$3/16$	$\frac{1}{4}$	N*
1	$\frac{1}{4}$	$\frac{3}{8}$	1	O*
1	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{3}{4}$	P*
1	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	Q*
1	$\frac{1}{4}$	1	$1\frac{1}{2}$	R*
1	$\frac{1}{4}$	$\frac{3}{4}$	$1\frac{1}{4}$	S*
2	$\frac{1}{8}$	$\frac{1}{8}$	2	T & W*
1	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	X
1	$\frac{1}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	Y*
2	$\frac{1}{8}$	$\frac{1}{8}$	$3/16$	Z*
4	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{4}$	Lifeboats

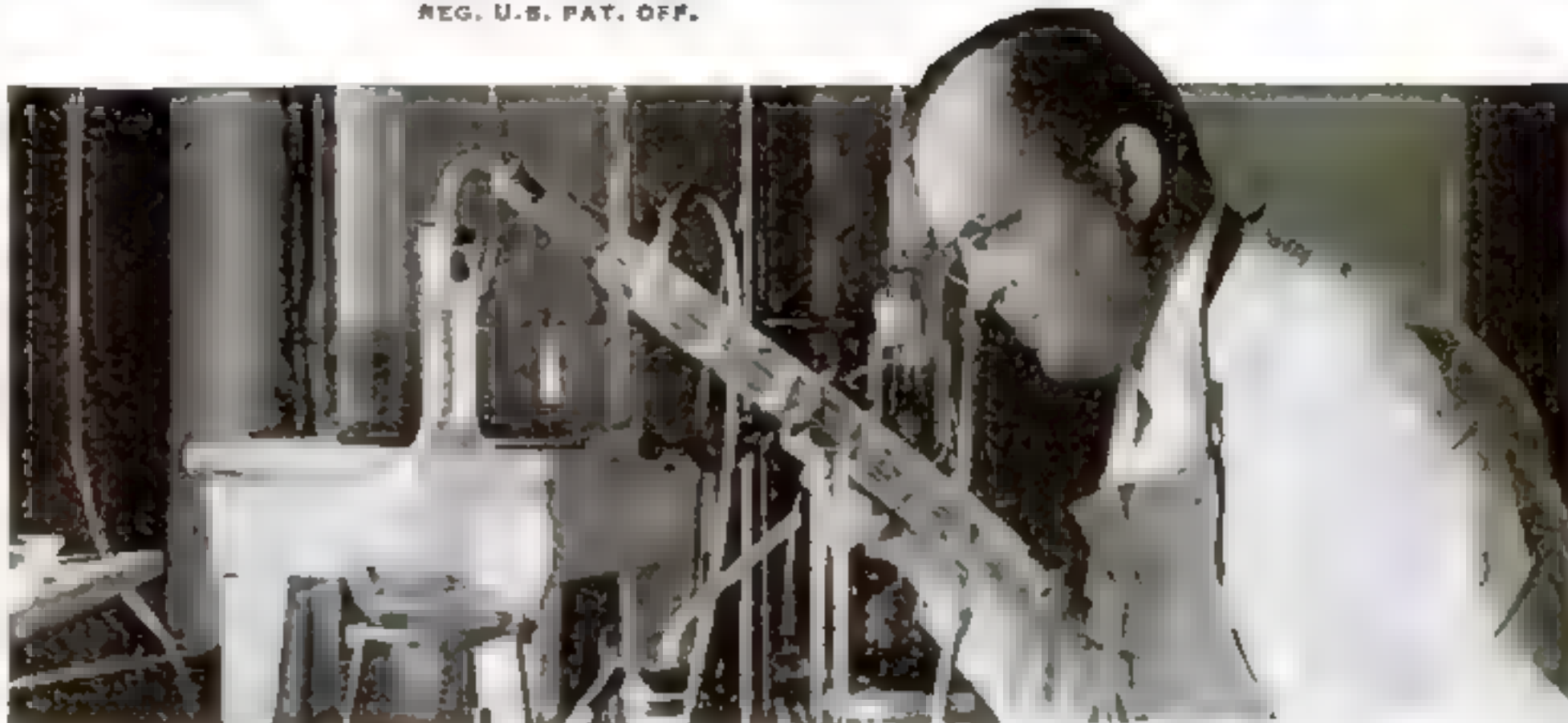
NOTE: Items marked with an asterisk (*) require no further cutting or carving.

MISCELLANEOUS

- 1 pc. $\frac{3}{8}$ -in. round dowel wood 1 in. long for funnel.
- 1 pc. $1/16$ -in. round dowel wood 10 in. long for masts, ventilators, propeller shaft, etc.
- 1 pc. fiber about 3 by 12 in. for rudder and sternpost, propeller, anchors, etc.
- 1 pc. card $\frac{3}{8}$ by $1\frac{1}{4}$ in. for *U*.
- 1 pc. card $\frac{3}{8}$ by 3 in. for *V*.
- 1 pc. black paper $\frac{1}{8}$ by 3 in. for pipe connection hatches, bollard bases, etc.
- 2 pc. split bamboo ($1/64$ by $1/64$) 12 in. long for deck piping.
- 34 pins $\frac{1}{2}$ in. long for catwalk supports, rigging, etc.
- 24 eyelets for portholes and windlass (very small size).
- About 3 ft. of thin stiff wire for davits, steam and whistle pipes, bollards, etc.
- Small mustard seeds for ventilator cowls.
- About 2 in. fine chain for anchor chains.
- Spool of No. 100 black thread.
- Black, white, red, and buff paint (or mix white with a little red and black to approximate buff).
- Glue or cement.

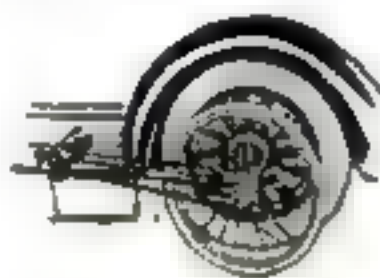
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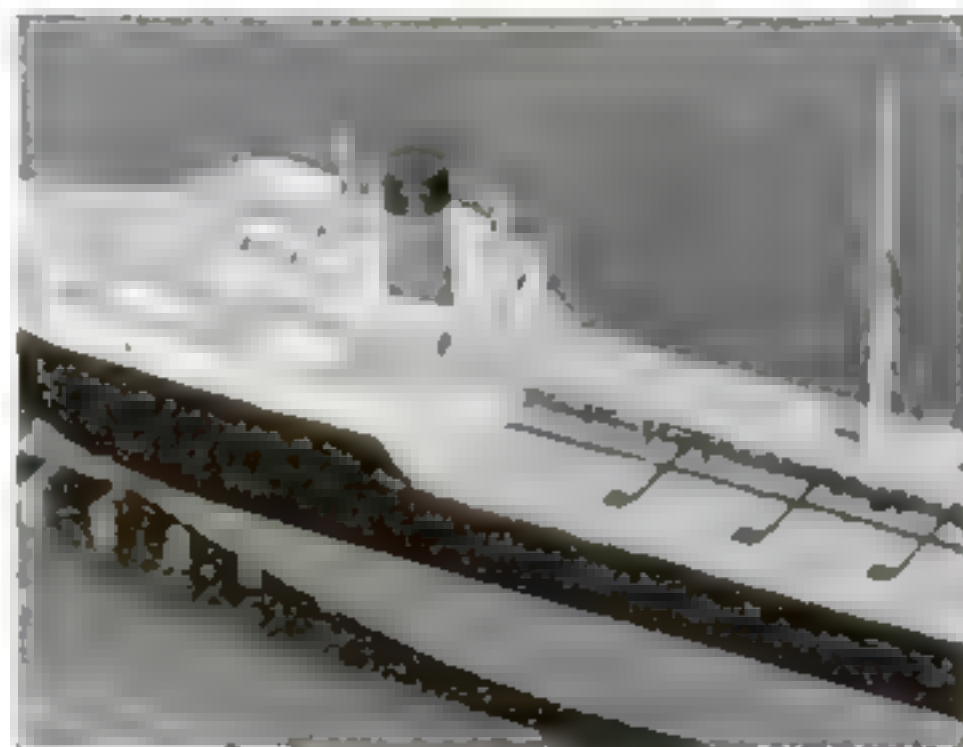
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SIMPLIFIED PLANS FOR A TANKER MODEL

(Continued from page 93)

superstructure. The gravity tanks Z support the rail V around the bridge house. The windows are painted on the engine-room skylight J. Ventilators are made by halving well-formed mustard seeds of suitable size, removing the centers, and mounting the resulting half shells on shaped dowels. The bollards are made simply by fastening small pieces of black paper to the deck, and driving two short pieces of wire through the paper and into



The aft superstructure, funnel, mast, boats, and the curious catwalk common to tankers

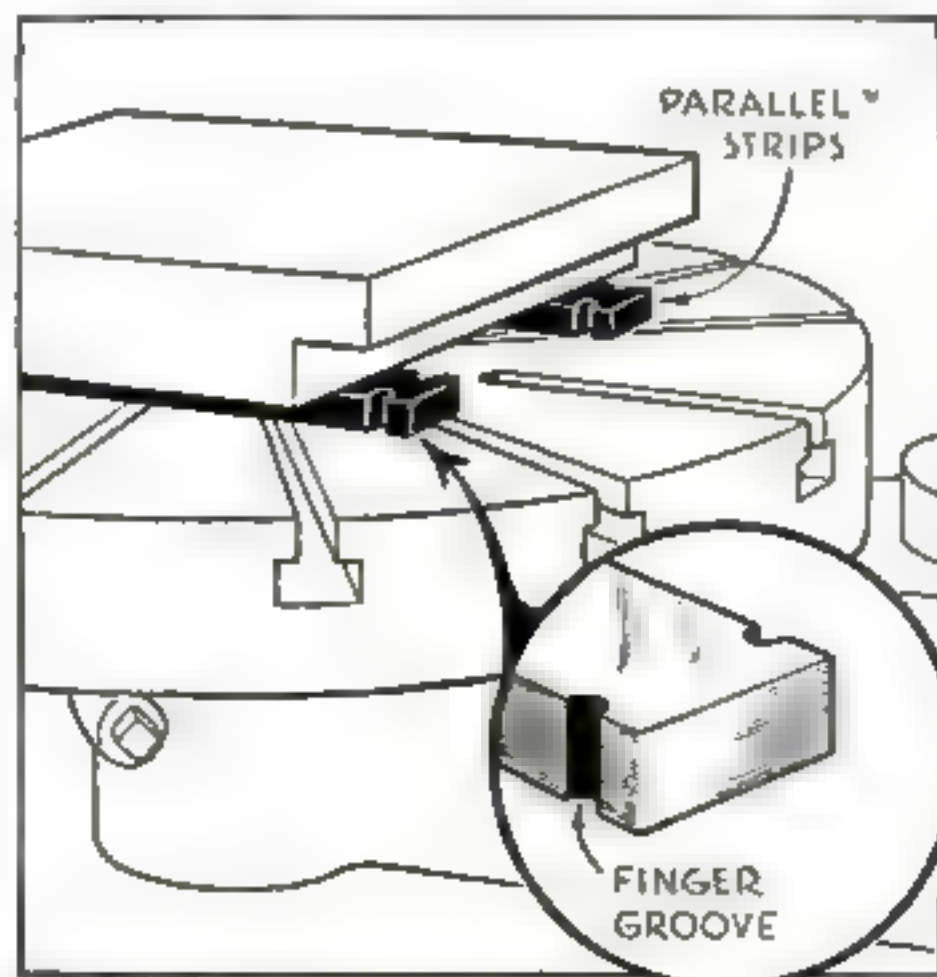
the hull. The protruding wire is then touched lightly with black paint.

The masts are round wood, tapered slightly with sandpaper, and must be inserted absolutely vertical. The rigging follows the usual lines shown in the drawing. The ends are held down by small pins driven into the hull and painted over to match the deck.

The deck piping and connection hatches are glued to the deck after everything else is completed and assembled. The piping consists of thin split bamboo, painted black and cut to length. The hatches are small squares of black cardboard arranged as shown.

If you intend mounting the model directly on a base, it is well to nail the underwater portion first, driving the nails through piece A into the base. The upper portion of the model can then be set and glued on A, and short dowels used for additional security, if desired. The model illustrated was mounted on a board $\frac{3}{4}$ by 4 by $18\frac{1}{4}$ in. and supported by twenty-six pieces $\frac{1}{8}$ by $\frac{1}{4}$ by $\frac{1}{2}$ in., which represent graving-dock blocks.

FINGER GRIPS IMPROVE SHOP PARALLEL STRIPS



FINGER grooves cut near the ends of parallel strips make them easier to shift when setting up work on planers, slotters, and presses, particularly when the work is heavy and bulky.—F. B

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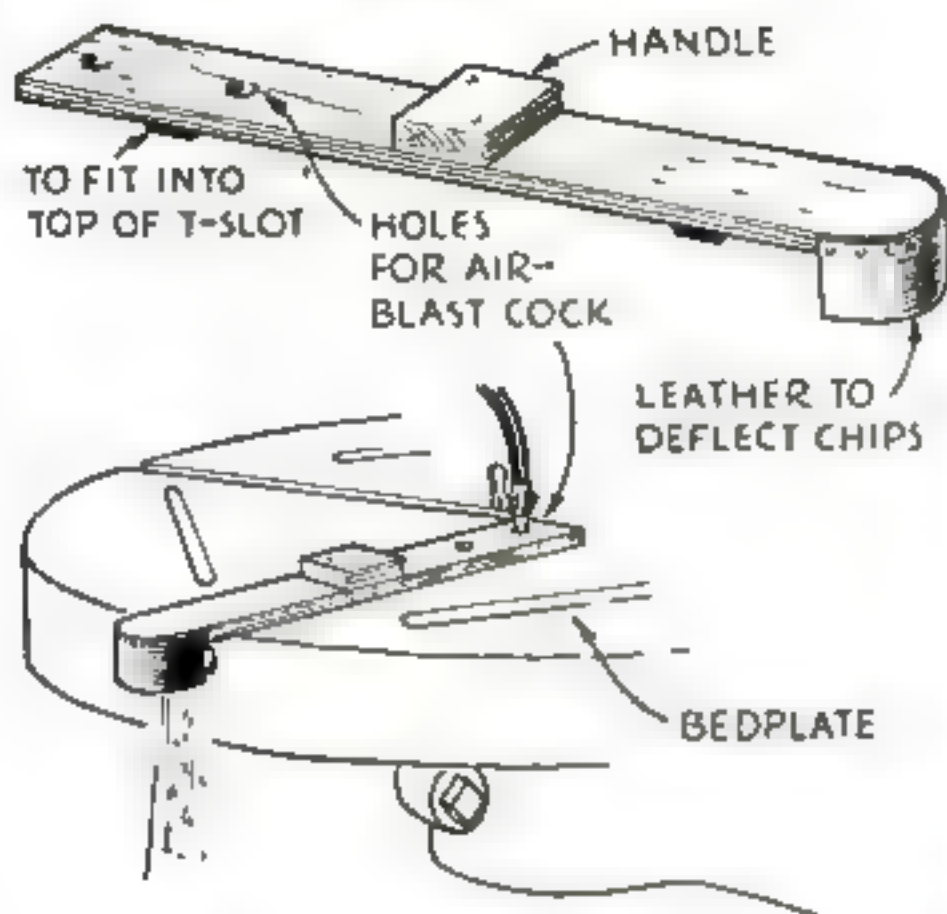
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ALL danger of flying chips, caused by using an air jet to blow out T-slots in the faceplates of drill presses, boring mills, and slotters, can be eliminated by constructing the device illustrated. The slots have to be absolutely clean to receive the heads of closely fitting studs and bolts, and a blast of air is the simplest way of cleaning them out.

Obtain a thin, strong stick wider and longer than the groove on the plate. Round one end and tack a fairly heavy piece of leather around it as shown. Fasten two small blocks to the underside of the stick to hold it in the groove, and drill two holes near the end into which the end of the air cock can be inserted. Use a small plug to stop whichever air hole is not in use.

HOMEMADE TOOL SHAPES METAL TUBING

(Continued from page 71)

Important point is to drive the neck in at right angles to the axis of the work in order to keep it from being lopsided, although it is, of course, entirely possible to straighten out a crooked neck. Another cause for crookedness is caused by driving the metal into the notch irregularly so that the hole is out of round. This is easily corrected. If the neck is to be driven in deeply, drive it in for only part of the way, then anneal and drive it in deeper, repeating the operation until the proper depth has been attained. Frequent annealing takes time, but will save spoiled work.

The largest individual piece illustrated in the photographic group on page 71 is only 3 in. long; and short lengths are to be preferred since it gives the worker greater opportunity to manipulate the metal over the end of the tool. The tall section at the right of the candle socket is not a single piece of work, but is built up from three separate pieces, and this method should be followed in the development of similar projects. It is possible to solder such parts together so that very close examination will be required to detect the joints. This requires nothing more than filing the parts to a perfectly fitting joint. Soft solder will answer most soldering requirements.

While not essential, it is desirable for many reasons to pickle the work after each annealing in a solution of sulphuric acid and water. It doesn't matter greatly what the strength of this is. If used cold, it should consist of about 2 oz. of acid to a pint of water. Keep it in a crock or similar earthenware vessel; if it evaporates, merely add more water. In this way the pickle will last the amateur almost indefinitely.

When longer tubes have to be ornamented, they may be filled with chaser's cement and hammered in a spiral design by a method described in an earlier article (P.S.M., June '34, p. 74).

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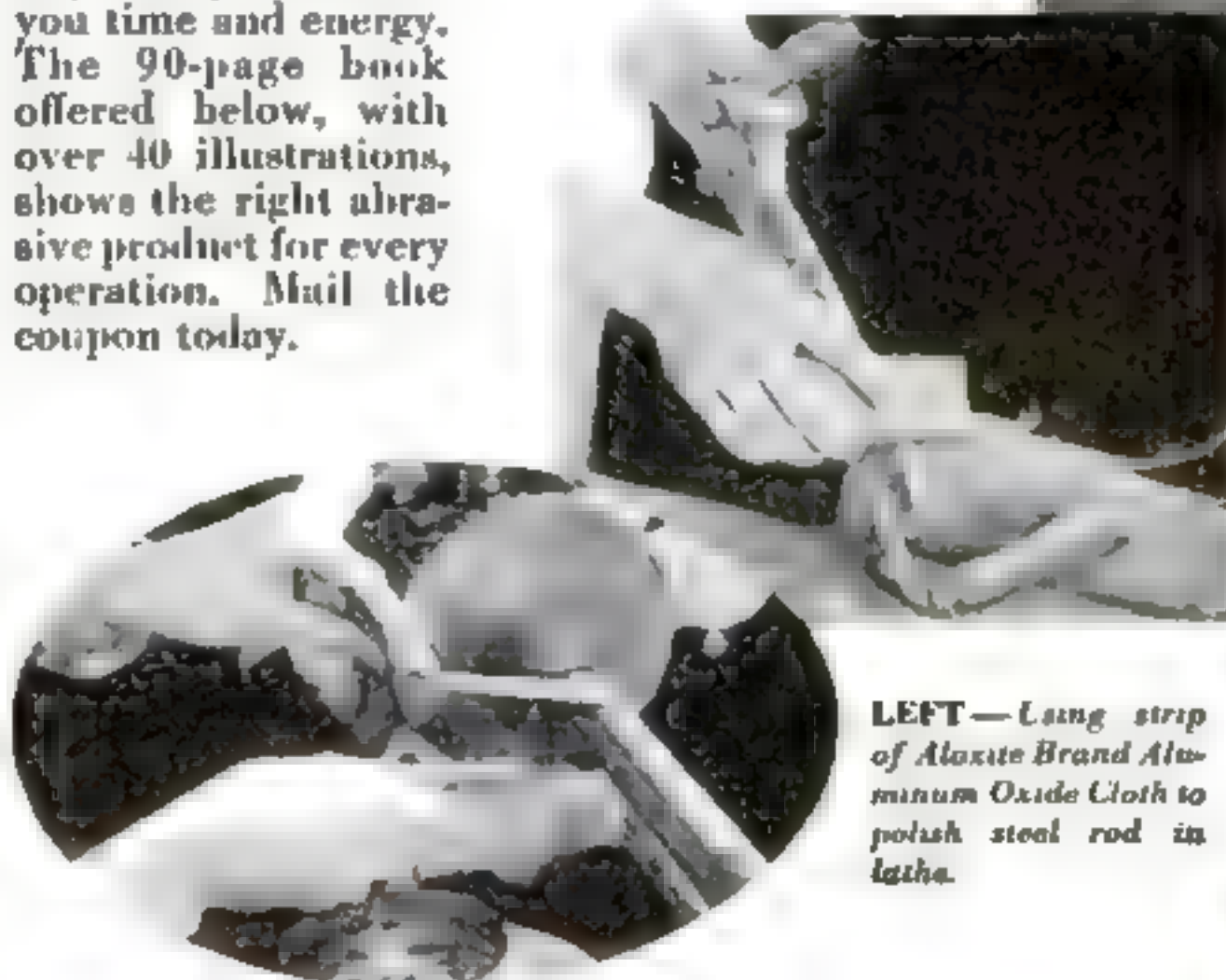
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LEFT—Using an extra large size Carborundum Brand Silicon Carbide Combination Stone to sharpen a draw knife.

BELOW—Cutting metal tubing with Carborundum Brand Silicon Carbide Cut-Off Wheel.



LEFT—Using strip of Aloxite Brand Aluminum Oxide Cloth to polish steel rod in lathe.

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HOW TO FINISH WROUGHT IRON AND GINGER JARS

(Continued from page 67)

armor metal by rubbing with fine abrasives.

The handles of the fireplace tools are first cleaned with the steel wool, and then with pumice stone and water applied with the 1-in. rubbing brush, which is worked around the knobs and turned portions. Those workers whose equipment includes a motor-driven steel scratch-brush buffer can obtain excellent effects by using it; and a felt wheel and pumice may be substituted later for a different type of polish if the scratch-brush effect seems too coarse. Next the handles are washed in hot water containing some washing soda or one of the trisodium phosphate cleaning powders. Follow with a clean, hot-water rinse and dry in the air.

After the metal is cold and dry once more, apply a coat of clear brushing lacquer, holding the pieces by the lower portions below the polished area. Hang up with fine wires and let dry hard. With clear lacquer this will take about an hour, after which the bottom sections can be brushed clean; wiped with an alcohol-saturated rag; dried and then coated with dull black lacquer applied with another brush than the one used for the clear lacquer.

To touch up the fire screen, a dry, new floor scrubbing brush is first used, followed by a painter's duster. The widest brush at hand is then chosen to spread black brushing lacquer or enamel, not directly on the screen, but on a piece of tin or glass in order to remove the excess. The brush is next lightly and quickly cross brushed over the screen, first in one direction and then the other. For a fresh supply, the brush is simply rubbed on the tin or glass as required.

Having practiced on the fireplace tools, you will feel more confident of doing well with such pieces as the ginger jars and their wrought-iron frames and holders.

THE metal is cleaned with No. 2/0 emery paper and denatured alcohol, as shown. Use a clean cloth saturated with fresh alcohol for the final wipe, and hold the work with a clean dry cloth to prevent finger spotting. In the case of the oval motif ivy stand, the finish decided upon was an antique or verd copper green. After the alcohol wipe, the frame is given a clear coat of brushing lacquer. As soon as it has dried, a small amount of copper brown enamel is spread on one side of an old china plate, and a bit of jade green is brushed out opposite. Next, two small scraps of cloth are rolled into separate bunches known as "pounces" in the paint shop, and held in shape with string or a small rubber band. A similar result can be obtained by clipping off small portions of sponge. In the case of the sponge, dip the pieces in water and squeeze out.

By using enamel over the clear lacquer, the effect can be increased, diminished, or otherwise modified as desired without "lifting" the lacquer from the metal, a procedure not possible where other types of enamels and varnishes are used in quick succession.

Hold the rag pounce or sponge between the thumb and first two fingers, being sure that the face of the rag is well wrinkled or folded unevenly. Apply lightly to the brown enamel, previously brushed out on the plate, so that the face of the pounce is covered evenly. Bearing in mind that this stand is to appear like green corroded copper, apply the brown coat in a light stippling motion from the base upwards and finishing with the top.

Next, take either a fresh pounce or a damp sponge and stipple on the green when and where you wish. The base should be a bit darker and browner. If the entire tone seems to be a bit new and bright, inclose some powdered rottenstone in a double thick cheesecloth bag (Continued on page 97)

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HOW TO FINISH WROUGHT IRON AND GINGER JARS

(Continued from page 96)

and lightly dust the entire piece with the brownish gray powder. Do not handle further, but set aside to dry overnight.

The next day, use a soft shoe brush or dry XXX varnish brush to dust off the excess rottenstone. The dusting is used to give the effect of time, handling, and indifferent cleaning, such as would be found on an old piece.

Much artistic work is possible by the simple methods just outlined, but in every case the craftworker is urged to strive for soft, subdued effects.

Because of the greenish glaze on the ginger jar, a dull black enamel was brushed on the ring stand. Where only gloss colors can be had in enamels, obtain a small can of eggshell or flat varnish made by the manufacturer of the enamels, and reduce small portions of enamel with an equal amount of flat varnish.

In the case of the colonial panel frame shown on page 67, good taste suggested a simple eggshell black. The frame was first turned upside down for doing all horizontal cross members; then turned right side up so as to start work at the lower portion and complete the entire frame. The final touch-up was made by holding the side-wall brackets until the top oval had been coated.

BUT, you say, "How did you glaze the jars in color?" Like the dessert at the end of a meal, I have been saving this glazing until the last.

Before attempting this kind of work, I suggest that you go to your favorite store and in the glass and china department study the color effects and glazes.

In my own case I wanted to obtain a rich Delft blue over the natural gray of the ginger jars, but with the gray tone showing through to soften and high-light the blue itself.

Note how the decorator in the center photograph on page 67 holds the jar, after its alcohol wipe, to prevent getting his fingers on the work in progress. In this instance he has a sponge pounce. By dipping the latter in water and squeezing it dry, the paint will not penetrate the sponge but will remain on the outer portion. The color usually should be applied somewhat heavier at the bottom of the jar; slightly less halfway up; considerably less on the shoulder where the high light or shine will occur naturally, and a bit heavier around the collar or rim.

For the jar shown, a bit of color from an artist's tube of blue was mixed with a trace of white enamel on a china plate until the desired shade was obtained. The pounce was applied to the color patch on the plate and then to the jar. A dry brush was used to blend the color more or less evenly by working in straight strokes from the *bottom* of the jar toward the shoulder, while the jar was held as indicated. Next the collar area was worked out and allowed to stand a minute or two for the enamel to "set." A clean, dry XXX brush was then touched with pure turpentine by allowing the tips only to meet a *film* of turpentine on a glass plate. By brushing lightly and evenly from the *shoulder* down towards the base of the jar, light streaks exactly like true glazes were secured.

It may be that your final effect is too bright or glossy, in which case it can be toned down by a coat of flat varnish. If no spray gun is at hand, it will be necessary to let the color work dry hard for a day or two, then use a 2½-in. soft, single thick varnish brush to apply a coat of dull varnish with quick *single* strokes, working from the bottom up and from the collar down to the roll of the jar. This must be fast, sure, and in single light brush-tip strokes or you will lift the color, and the job must then be repaired by touching up when the varnish is still wet.

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GUILD SETS UP PROGRAM SERVICE BUREAU

(Continued from page 69)

services are being made available to the secretaries of all clubs that have received charters from the Guild. And the number of clubs affiliated with the Guild is increasing rapidly. Since an announcement was made several months ago that national dues had been abolished, nearly 100 new clubs have joined in order to participate in the Guild's many activities.

Some of the major industrial firms of the country have prepared films about their work. They realize that it is often possible to demonstrate a process much more clearly through the medium of the motion picture than through an actual visit to a plant. The Program Service Bureau of the Guild lists these pictures and tells how they can be borrowed without charge. There are approximately 100 films on topics ranging from the manufacture of steel to sculpture which home workshop clubs will find of especial interest to them.

Home workshop experts in eighty cities and towns throughout the United States and Canada have volunteered to speak to clubs located in their own districts. Among the many subjects upon which they are qualified to talk are the following: architecture, astronomy, boat building, care of tools, carving, electricity, furniture making, house repairs, inlaying, leather work, metal work, microscopy, model making, painting and finishing, photography, reading drawings, shop equipment, upholstering, veneering, and woodworking.

All of these men have been contributors to POPULAR SCIENCE MONTHLY. Many teach the subjects listed, while to others they are hobbies. Several have prepared illustrated lectures, and most of them are willing to give actual demonstrations of their work.

Manufacturers, dealers, and industrial firms are enthusiastically cooperating with the bureau by providing free booklets, samples, and, in some cases, demonstrations of how their tools or products are used.

This is the first time that a Program Service Bureau of this type has been provided for home workshop clubs. The Guild is also preparing other services, which will be announced later, in order that the home workshop club movement will continue to progress as rapidly as it has during the past three years. It was late in 1933 that the Guild was organized, and nearly 300 clubs have since been granted charters.

HOME WORKSHOP CLUBS GROW MORE ACTIVE

SPURRED to greater activity because of the services now rendered by the National Homeworkshop Guild, many of the affiliated clubs throughout the country are conducting membership drives and laying out elaborate program schedules. Members find their craftsmanship is improving, so more clubs are planning exhibitions than in past years. Additional clubs have also arranged for special craftwork classes.

Ship Craft and Model Engineering Guild, Cincinnati, Ohio. The members have started work on a model of the Baltimore and Ohio Royal Blue streamlined train. E. J. Schilling has been placed in charge of the mechanical end of the project, and the work has been apportioned among the members. Meetings are held every Tuesday night. Victor Freidenheim, the treasurer, is especially active in the club's campaign for new members.

Coulee Dam (Wash.) Homeworkshop Club. Most of the members are still working on lawn furniture and trellises, although a few are finishing up furniture pieces started last spring. Interest in home workshop activity has increased greatly since the club was organized.

(Continued on page 99)



See the surface of this block at right. Shows wood gave way, and not LePage's.

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HOME WORKSHOP CLUBS GROW MORE ACTIVE

(Continued from page 98)

Putnam (Conn.) Homeworkshop Club. Organized recently with seventeen charter members, this club has elected Felix Holda president; Joseph Landry, vice president; Leonard Gilman, secretary; George Carlage, treasurer.

Kenilworth (N.J.) Homeworkshop Guild. The members have visited a machine shop in a local wire factory and the Newark Airport. Experimental work has been started on an airplane engine. Several members are building a tractor for use on a farm.

Col. William H. Waldron Homeworkshop Guild, Missouri Branch, W. Va. Upon completion of the new workshop, classes will be conducted by Capt. Franklin W. Patten in woodworking, leather work, and belt weaving. Colonel Waldron, in whose honor the club was named, was made an honorary member at a recent meeting.

East Side Sawdust Eaters Homecraft Club, Detroit, Mich. Among the events held during the summer were a boat trip on a cabin cruiser made by one of the members, and a golf party and picnic. The club recently held its first annual exhibition.

Club des Artisans Amateurs, Trois Rivières, P. Q., Canada. A special model makers' division is being organized this fall with the assistance of the Cartier Homeworkshop Club of Montreal, which has offered to lend blueprints, plans, catalogues, and other data. C. B. Meyers recently gave six volumes of *POPULAR SCIENCE MONTHLY* (1933-35) to the club.

Cartier Homeworkshop Club, Montreal, P. Q., Canada. Since all the members are interested in model railroads, the club recently inspected the famous C.N.R. locomotive No. 6400 and C.P.R.'s No. 3000. Working plans are being drawn so that models can be made.

West St. Louis Homeworkshop Club, St. Louis, Mo. Photography is the main subject being studied by the members this fall. A membership drive is being conducted. The secretary is Kenneth R. Fix.

Fayette Homeworkshop Club, Fayetteville, W. Va. E. M. Darnall has been elected president; E. R. Crouse, vice president; Beryl Vickers, secretary-treasurer. The board of governors consists of W. P. McGrady, A. C. Givens, E. G. Bragg, and C. E. Howard. The club had an exhibit at the Mining Institute at Mount Hope, W. Va.

SEND FOR INFORMATION ON STARTING A CLUB

IF THERE is no local club affiliated with the National Homeworkshop Guild in your locality, send the coupon below for a free bulletin that gives complete information on organizing a club.

The Guild offers to all amateur craftsmen the opportunity of enjoying real coöperation and companionship in their hobbies. It has nothing to sell and is entirely noncommercial. Until this year annual membership in the national organization cost fifty cents a member, but this charge has been eliminated so that now home workshop enthusiasts everywhere can receive the benefits of belonging to the Guild without paying any national dues.

National Homeworkshop Guild
347 Fourth Avenue, New York

I would like to organize a home workshop club. Please send me without obligation a bulletin explaining in detail how to get a club under way and obtain a charter. I am inclosing a large (legal size) envelope, self-addressed and bearing a three-cent stamp, for your use in sending me this material.

NAME

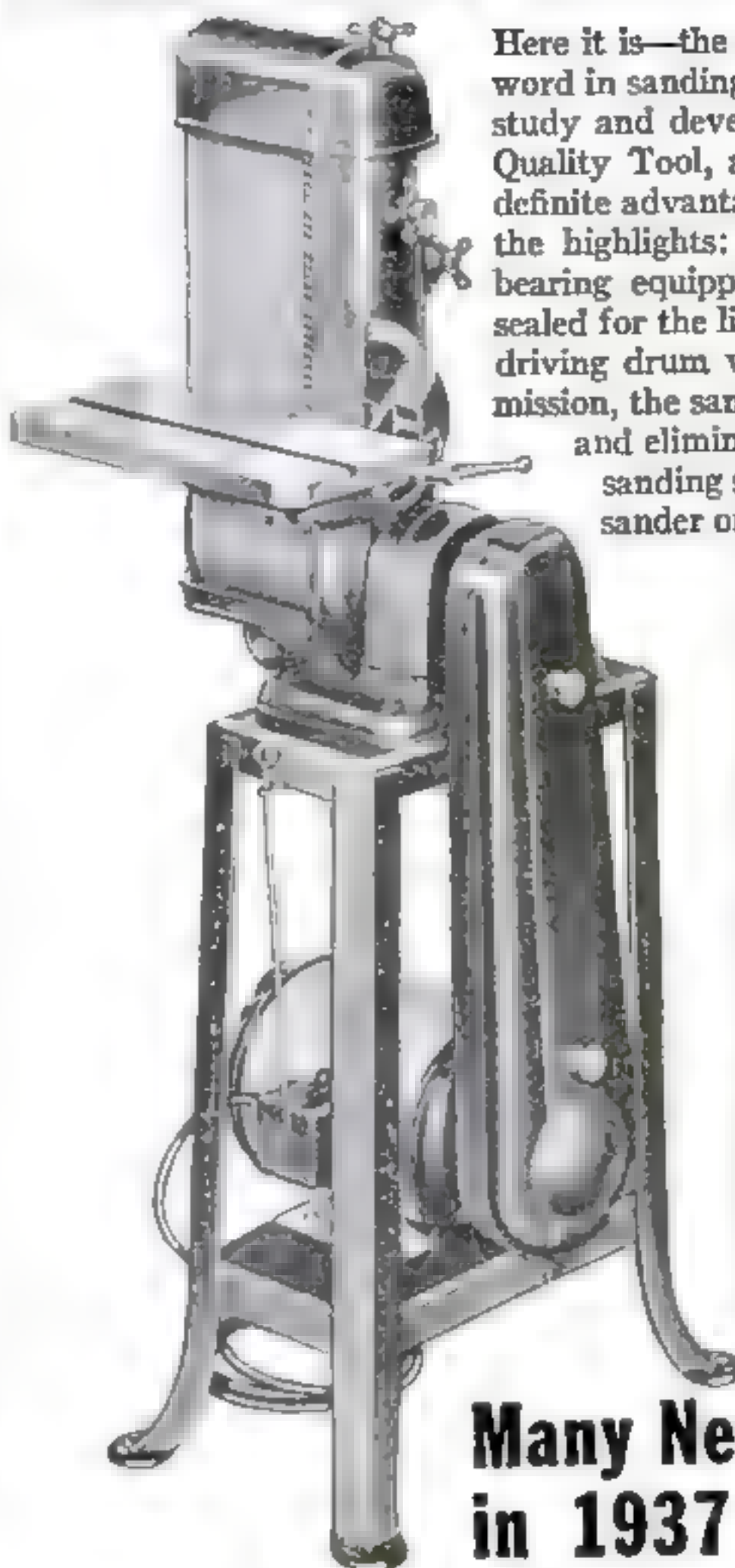
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CITY STATE

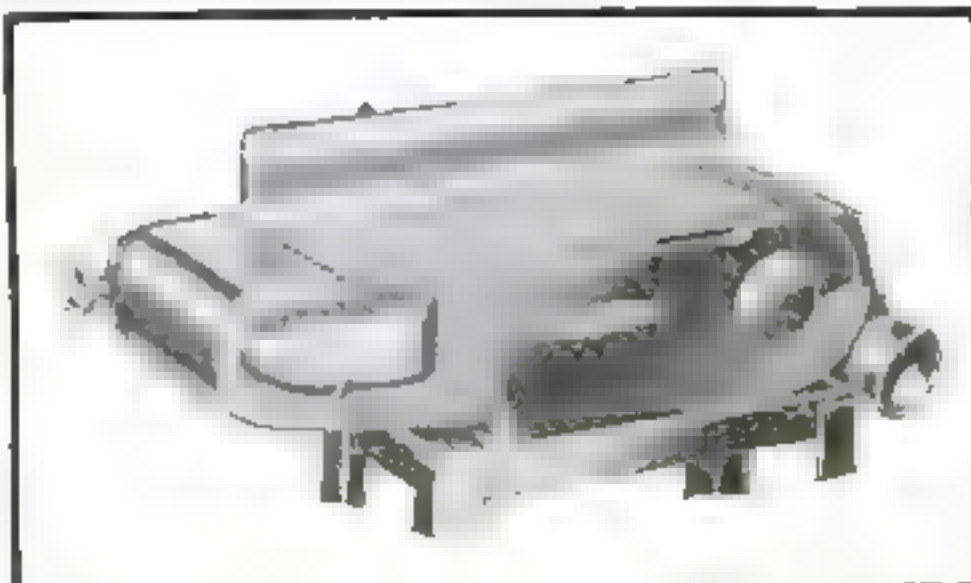
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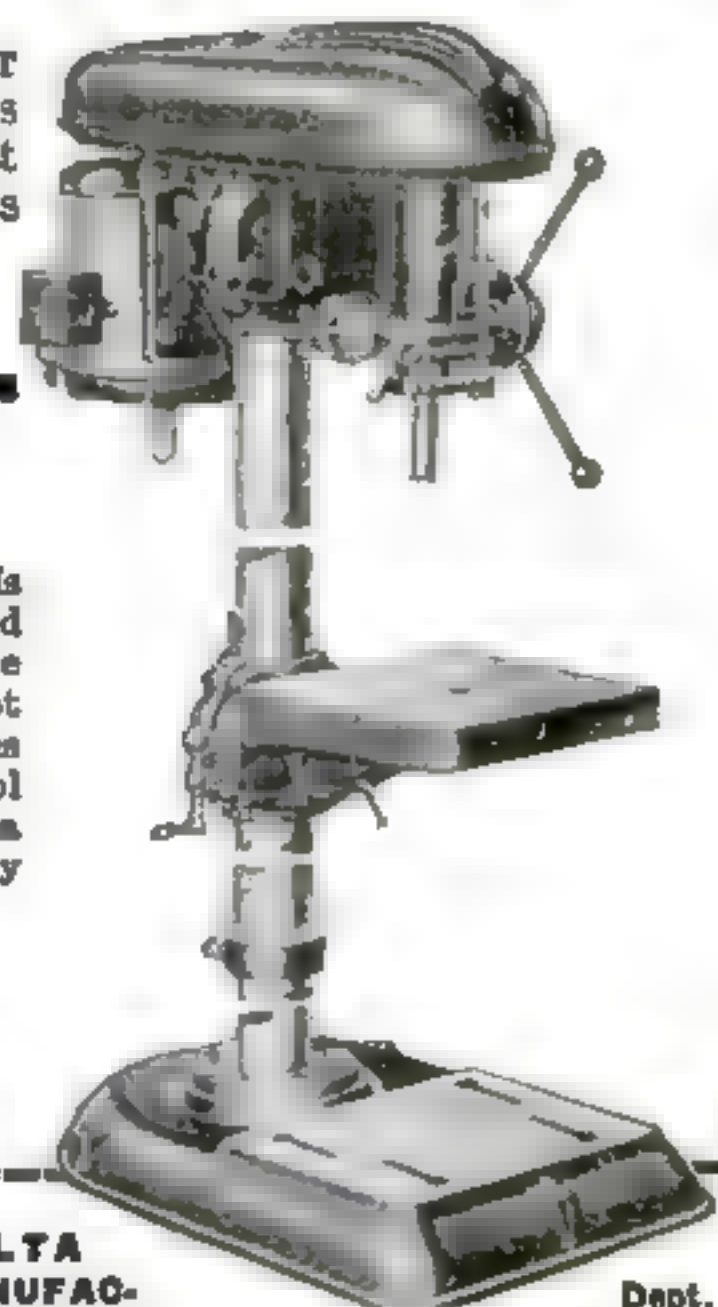
and vertical positions. Provided with efficient dust and shaving deflector with arrangement for suction fan. Tilting Table, Automatic Stop that automatically squares tilting table. Auto-Set Miter Gage, Adjustable Back Stop, Adjustable Fence, Lapless Sanding Belts, all available for this machine. See latest Delta Catalog for full details.

Many New Features—New Tools in 1937 DELTA "Quality" Line!

Every man interested in motor driven tools for home or factory should see the new 1937 Delta Catalog. No pains have been spared to make the latest Delta tools the most complete and efficient line of low-cost motor-driven units ever presented.

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In order to eliminate conflict of trademarks in some countries, the Delta Mfg. Company of Milwaukee, Wis., U.S.A., announces that its complete line of "Delta Quality" tools will be known henceforth as "Tauco Quality Tools" in all countries of the world except the United States and its possessions. At the same time, we wish to state that "Tauco" tools and "Delta" tools will be identical in every respect in quality of material, accuracy of workmanship design, conveniences, size, weight, and method of construction.

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Name..... Age.....

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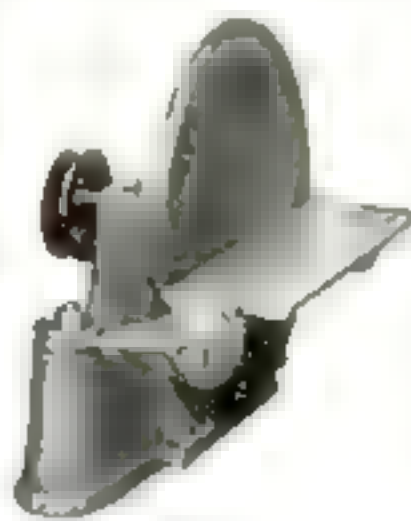
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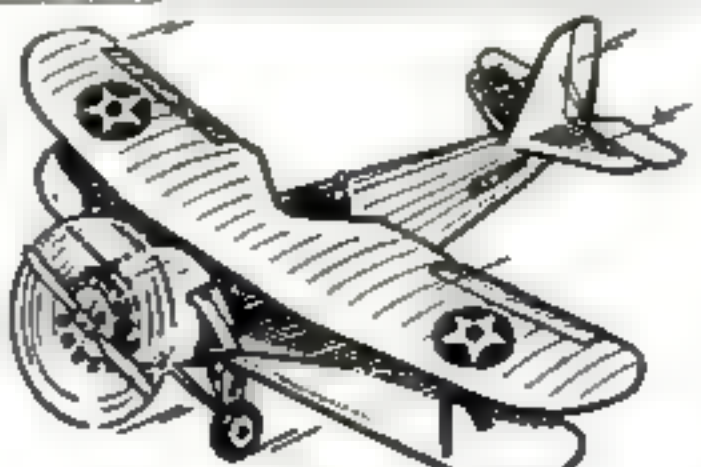
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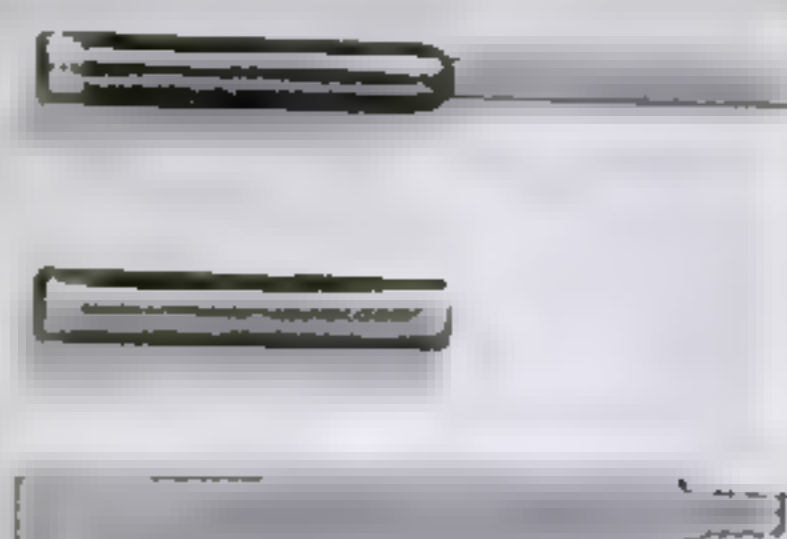


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TURNING CHISELS MADE FROM PLANER BITS

FIRST-CLASS chisels for wood turning are necessarily expensive, but good substitutes can be made from old high-speed steel planer bits, which may be obtained at almost any saw mill or planing mill.

The chisel illustrated has a handle made from 1/2-in. pipe because most ordinary planer bits are about 8 in. long and if a wooden handle were used, the tang would take up half the stock; also, if the chisel is dropped, the heavy handle will strike the floor first. The



Blade with end notched for fastening in the handle; a pipe handle; and a completed chisel

shank of the chisel is ground to a loose fit in the handle and then notched. The notched end is set in the handle about 1 1/2 in., which is filled to within 1/2 in. of the other end with asbestos or dry clay. The space around the chisel is then brazed or filled with hard bab-bitt, and the other end is also filled.

When grinding the chisel to shape, or sharpening, it is not necessary to avoid heating as the high-speed steel retempers itself on cooling. Also, there is no danger of drawing the temper when turning hardwood at high speed.—W. C. C.

MINIATURE TREES FOR YOUR MODEL RAILWAY

(Continued from page 66)

disinfectant in the mixture will prevent the bread from becoming moldy. Daub the branch ends with glue and lay on bits of bread. When they are dry enough to be firm, build up with larger pieces, made ragged with a scratch awl.

Remember the leaves grow where sunlight can reach them, thus making a covering for the tree and leaving the inner branches somewhat bare. This is true even of the dense cedar, which from the outside appears to be a solid mass of green. There is a temptation to apply the foliage in little dabs, leaving many little clumps with branches showing between, but this treatment results in a niggling effect and should be avoided.

Firs and similar trees are built on a tapering stick. Drill irregularly spaced holes around the trunk, forming rough circles, and insert wire branches in the lower holes. The others are supplied with splinters of pine that have been boiled in water. Dip the butts in glue, and break them in two or three places to make them crooked.

Rubber sponges furnish good material for evergreen foliage. Cut diamond-shaped pieces, notch into the edges with scissors, and bevel the resulting prongs. Build up by starting with the lower branches, and leave some bare limbs to indicate that the fir has weathered hard winters.

Carefully made trees such as these should stand alone or in front of thickets. Trees used behind them or inside thickets may be faked very simply.

Cedars are easily made by cutting sponge branches as for firs, and gluing them pointing upward on turned wooden cones.

C'MON MAC—BE A REAL SPORT AN' SAY YOU'LL GO...



— BUT
MAC'S
PIMPLY
SKIN
MADE
HIM
AVOID
"DATES"

JUST MY BUM LUCK TO GET
THESE DARN BLOSSOMS
WHEN I WANTED TO MAKE
A REAL HT WITH JOE'S
SISTER — THEY'RE GETTIN'
WORSE LOOKIN' EVERY
DAY, TOO



LOOKIT LITTLE
WHOOSIS
ADMIRIN'
HIMSELF

ADMIRIN' NOTHING—
SAY JEFF DO YOU
KNOW ANY WAY I CAN
GET R'D OF THESE
BLAMED PIMPLES?



SURE I DO—JUST
YOU GET SOME
FLEISCHMANN'S
YEAST THAT'S
WHAT FIXED UP
ALL THOSE
PIMPLES I HAD.
CLEANED THIS
OLD PHIZ RIGHT
UP!

THAT STRAIGHT,
JEFF P. GOSH!
I'D BETTER
GET SOME
QUICK



LATER
MAC SURE IS HITTING IT
OFF SWELL WITH SIS—AN
SAY DOESN'T HE LOOK
THE TOPS NOW THOSE
PIMPLES ARE GONE!



YOU SAID IT! GOOD
THING I TIPPED HIM
OFF TO THOSE
YEAST CAKES
IN TIME

Don't let Adolescent Pimples Keep YOU on the side lines

Any boy or girl hates to be
seen with a pimply skin.
Yet pimples are very com-
mon after the start of ado-
lescence—from about 13
to 25, or longer. At this
time important glands
develop. This causes dis-
turbances in the whole
body. The skin gets over-
sensitive. Waste poisons

in the blood irritate this
sensitive skin. Pimples
result.

Fleischmann's fresh
Yeast helps to clear these
skin irritants out of the
blood. Then, pimples van-
ish. Eat 3 cakes daily, one
before meals—plain, or in
a little water—until your
skin clears.



—clears the skin
by clearing skin irritants
out of the blood

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HARDWARE OF ANTIQUE APPEARANCE WHITTLED FROM WOOD

ANY one who enjoys whittling can make decorative hardware from wood when necessary. This is an especially useful expedient when it is desired to imitate antique wrought-iron fittings. The illustrations show a whole set for a small hope chest, all carved from mahogany. The wood was stained with a solution of kali (glasswort) and given three coats of shellac.

The two hinges were made from two pieces $\frac{3}{8}$ in. thick and about 3 by 7 in., two pieces $\frac{3}{8}$ by $2\frac{3}{4}$ by $4\frac{3}{4}$ in., and two more pieces

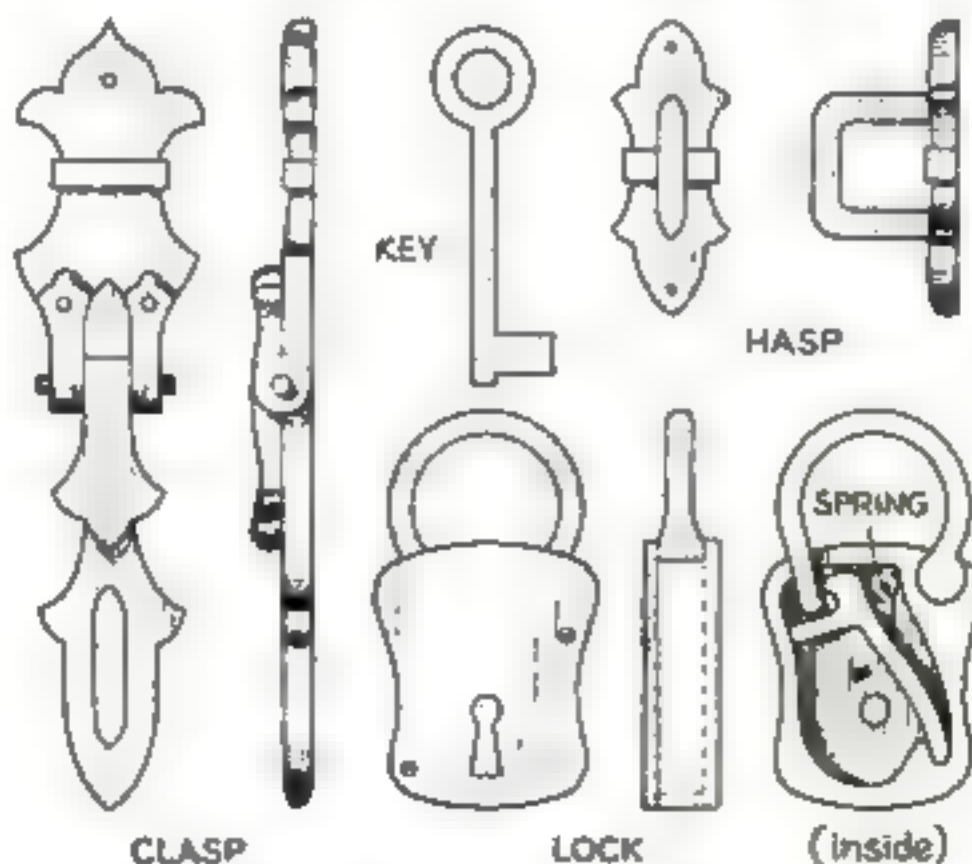
4 in. long and about $\frac{3}{4}$ by $\frac{3}{4}$ in. square. After the four flat pieces had been cut out, a $\frac{1}{4}$ -in. hole was drilled lengthwise through the two pieces of square stock, which were then planed down to the proper size. They were cut into three pieces each to fit the flat parts, and a $\frac{1}{4}$ -in. dowel was pushed through the three of them. The two flat parts of the hinge were placed in their proper position and the pieces of square stock were glued in place. After the glue dried, the dowels were withdrawn and all the parts sandpapered while separated.



Half pattern for the hinge, and edge view



Ornamental hinges, clasp, hasp, padlock, key and chain for a hope chest, all made of wood



How the other pieces are shaped. One view of the padlock shows the interior mechanism

The clasp was made from two $\frac{1}{2}$ -in. pieces; the hasp from a piece 1 by $1\frac{1}{4}$ by $2\frac{1}{2}$ in. In making the lock, the shape, inside and out, was drawn on a piece of $\frac{1}{2}$ -in. stock.

The inside was first cut out $\frac{3}{8}$ in. deep, and the sides and bottom were smoothed. The outside was then cut, and a small piece of $\frac{1}{8}$ in. stock of the same shape was screwed on and sandpapered smooth. The cover was then removed, and the two movable parts were fitted. A small piece of watch spring was inserted as shown, and the keyhole drilled and cut. The key and an eight-link chain were whittled from a single piece of wood, as illustrated in the photograph.—WILLIAM HARVEST.

NUTS HELD WITH SOLDER TO PREVENT TURNING

WHEN a nut in an inaccessible place keeps on turning instead of unscrewing properly, it can sometimes be held by soldering it to the metal to which it is bolted. Then, after the screw has been removed, the nut can either be pried off with a screw driver or left on if the screw is to be replaced.

Another method is to solder a length of heavy copper wire to the nut to prevent it from twisting with the screw. This also guards against the nut's falling into a hole where it could not be reached.—WALLACE H. McCLOY.

PHOTO PRINTER DUPLICATES TYPEWRITTEN NOTICES

NOVEL, yet easily prepared, post-card notices of club meetings, entertainments, and other events can be made by anyone interested in photography. The copy should be neatly typewritten on a piece of ordinary tracing paper and used in a photographic printing machine just as if it were a negative. The prints are made on a No. 4 or 5 grade of post-card stock.—R. STANLEY WERNER.



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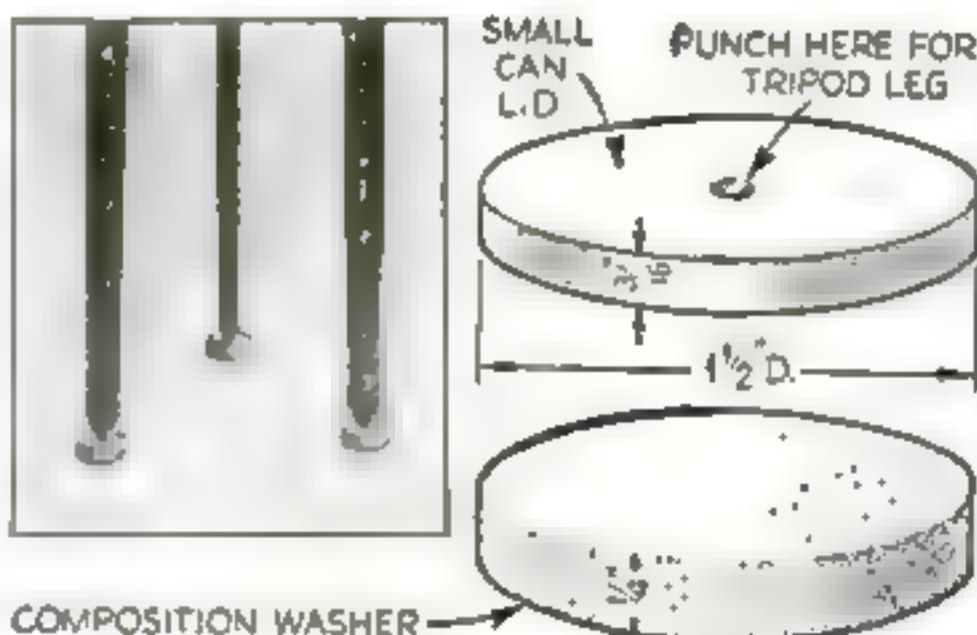
(Continued from page 78)

the ears when necessary. Three roundheaded wood screws evenly spaced about the circumference allow the diffuser to be snapped into the front of the reflector.

The light distribution of this reflector was measured with a foot-candle meter. With a No. 1 photoflood in the reflector, the light intensity directly in front of the reflector and 5 ft. from the center of the bulb, with the small reflector in place, was found to be 150 foot candles. Fifteen degrees away from the center line, at the same distance, the intensity was 100 foot candles, and 30 deg. off center it was 40 foot candles. With the small reflector removed, the intensity at the same distance directly in front of the reflector was only 140 candles; at 15 deg. off center, 100 foot candles; and at 30 deg. off center, 80 foot candles. Experiments showed that moving the small reflector away from the bulb decreased the front light and increased the side light, the total radiation, of course, staying the same.

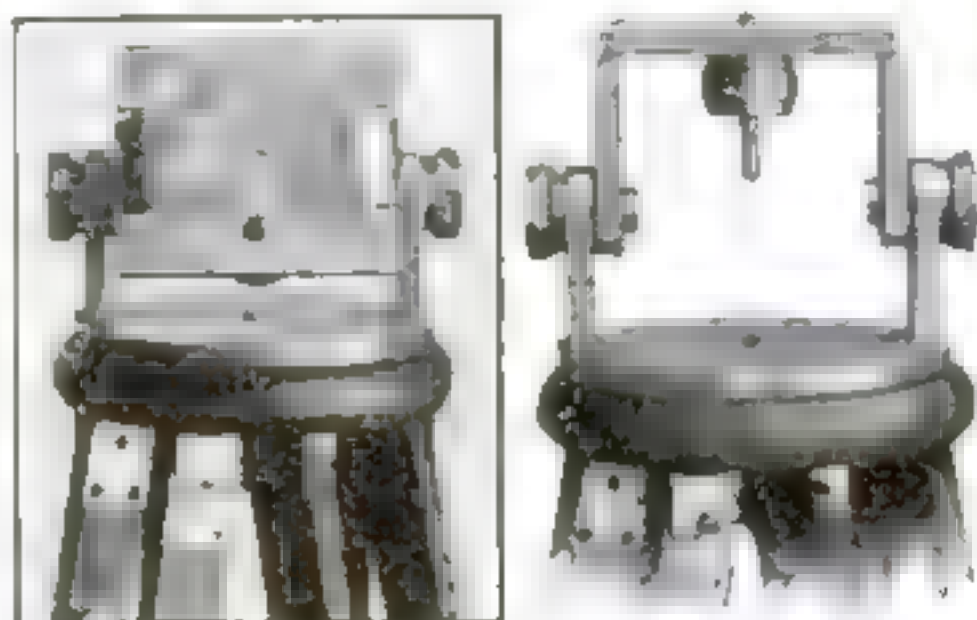
In the lamp illustrated, a push-button socket is shown, but after a few minutes of use, the composition push buttons melted, making it impossible to turn the light off at the socket. Most of the heat is carried away by air currents entering holes in the shade holder and passing out at the top.

NONSKID PADS PREVENT TRIPOD FROM SLIPPING



Composition disks pressed into the lids of small cans keep tripod from marring floor

NOW that indoor photography has become so popular, the problem often arises of placing the camera tripod solidly without marring the floor with the sharp pegs in the tripod feet. A good solution is to make nonskid pads as shown. These are composition disks cut from a 15-cent Ford-motor insulating pad and pressed into small can lids.



UNIVERSAL TILTING TOP

ANY standard tripod enables a camera to swing in a circle, but to tilt the camera it is necessary to change the set of the legs or shorten one leg. Often this is difficult to do, and it always takes time. With the tripod top shown above, however, one can swing the camera and tilt it through any angle, even to point straight up or (Continued on page 103)



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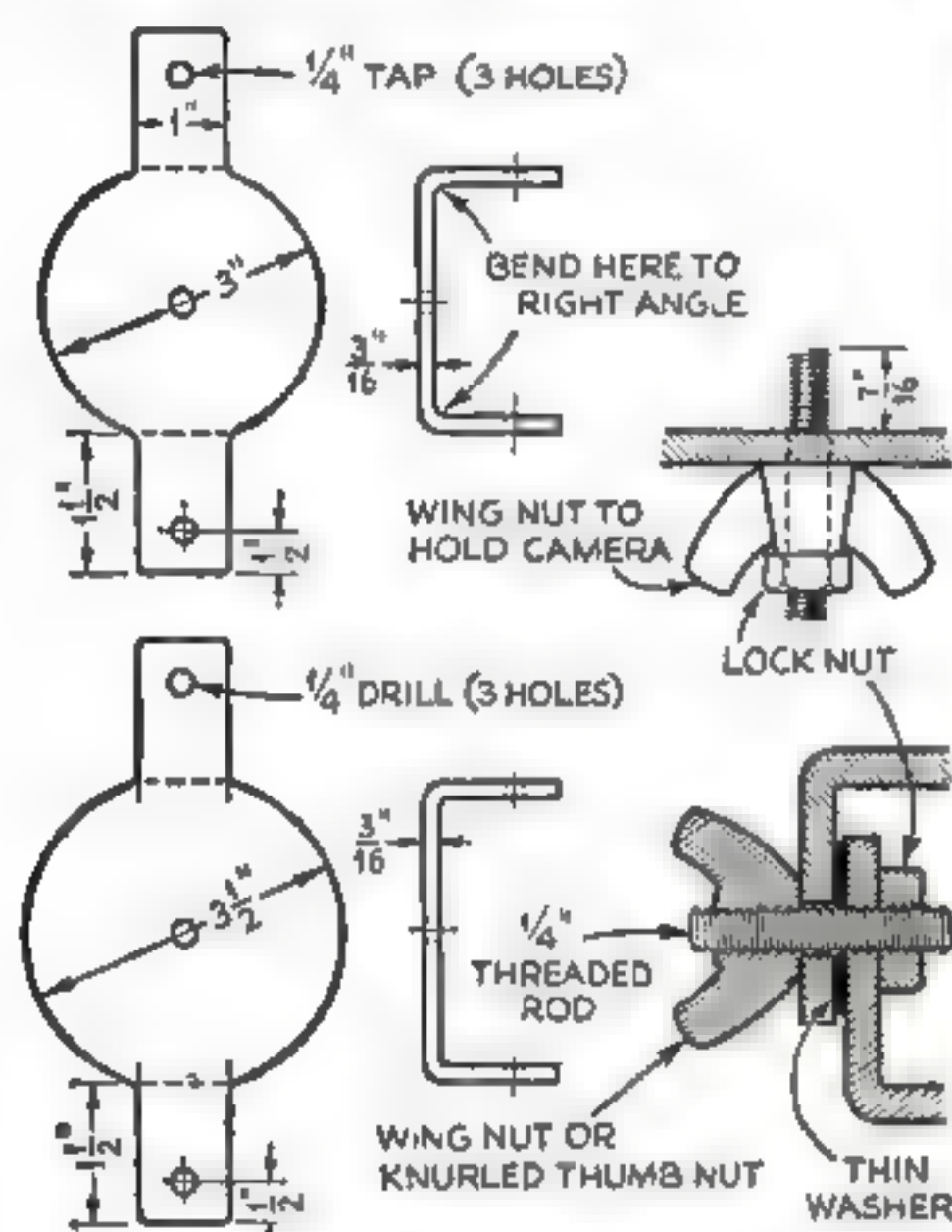
K-D MFG. CO. DEPT. 10 LANCASTER, PA.

UNIVERSAL TILTING TOP

(Continued from page 102)

down. This feature is especially useful with the home movie camera.

A piece of sheet aluminum about 3/16 by 3 1/2 by 12 in. will make the frame. Either wing nuts or knurled thumb nuts may be used to hold the head. Wing nuts and a piece of 1/4-in. threaded rod (to fit the tripod socket of the camera) may be obtained in almost any hardware store. To make the movement of the head smooth, it is advisable to place a fiber or cardboard washer between the two parts of the head. The cost of materials for the model illustrated was \$1.50.—W. C.



By following these simple diagrams, you can build a tripod top that tilts to any angle

HINTS ON HOW TO COLOR PHOTOGRAPHS BY HAND

THE art of coloring photographs by hand is an enjoyable hobby; and for those who develop skill in the work, it offers surprising possibilities for earning extra money. I can vouch for this because in the past eight years I have colored and sold thousands of photographs—well over 200 a week for many weeks each year. My pictures are of college buildings and fraternity houses and are sold to students.

The materials required are a booklet of twelve transparent water colors, two or three brushes, a number of pieces of hard white blotting paper cut about 3 in. square, and a dozen small mixing pans. Metal bottle caps make excellent pans. I use three brushes: a 3/8-in. flat camel's-hair brush for washes; a No. 1 camel's-hair for spot and trim work; and one 1/8-in. sable-hair for all detail work. Be sure the blotters are hard and not colored or soiled.

Practically any photograph may be tinted successfully if the natural colorings are studied. If possible, however, make your pictures in the autumn, when the leaves are turning. These will photograph lighter and with more detail and will give better opportunities for bringing out the colors. Autumn pictures are more beautiful and in greater demand.

I do all of my coloring on dry prints. Occasionally it will be found that a print will not take the color evenly, but this may be overcome by wiping the face of the print with a cloth wrung out in warm water.

The only color I use as it comes from the book is scarlet. This is for sunsets and for toning down the (Continued on page 104)

Again ENGINEERED QUALITY Gives You More For Your Money In These NEW DRIVER TOOLS for 1937

DRIVER 3-IN-1 UNIVERSAL SURFACER

(Series 700) Combines features never before offered! This tool will handle all three types of surfacing, yet it's a model of simplicity. Belt sanding on the upper belt surface, "stroke" surfacing under the lower belt surface, and butt-end or mitre sanding with the big 10" disc. Surfaces panels up to 13" wide—a feature never before available to you in a low priced machine. 4" wide belt, 18" between pulley centers. Tilting table at disc, with mitre gauge. For full details, send the coupon.

DRIVER SURFACER (Series 900) A full production tool. Like the 700 Series, it surfaces wood, metal, plastics, fibre, etc. Has efficient dust collecting system. Rolling table under belt for "stroke" surfacing. Many other quality features.



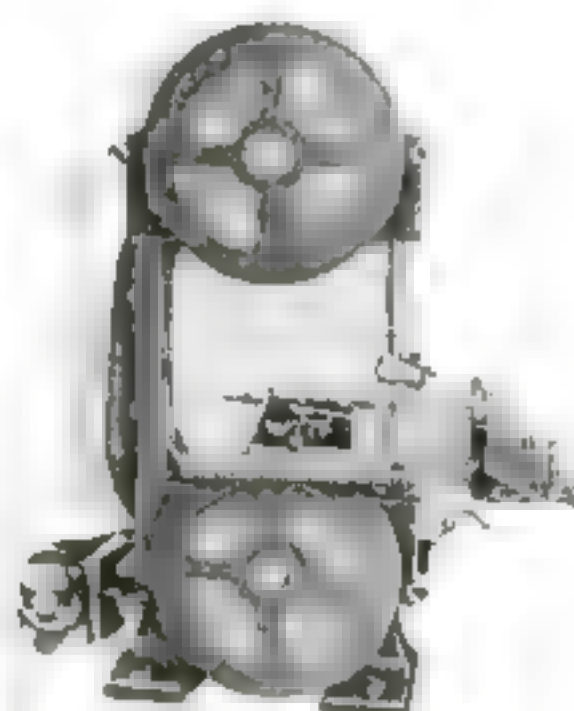
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10" BENCH SAW

Has unusually large table, plenty of room in front of blade. Cuts full 3" stock! New "kick back pawls" prevent stock being thrown toward operator. New safety guard. Precision worm gear table tilting device. Positive mechanism for raising arbor and blade. Strong ripping fence. Splitter. Get details in the 1937 folder and you'll agree it's the biggest saw value ever offered.



16" BAND SAW

This new Driver tool has fine appearance and graceful lines, but doesn't stop at that! Cuts true; operates without vibration; protects operator; stands up without repairs. Cutting capacity 12", throat 16". One-piece frame, 18" x 17" table tilts to 45°, with calibrated quadrant, SKF ball bearings. Completely guarded—no section of blade exposed while sawing. Get the whole story in the colorful 1937 folder!

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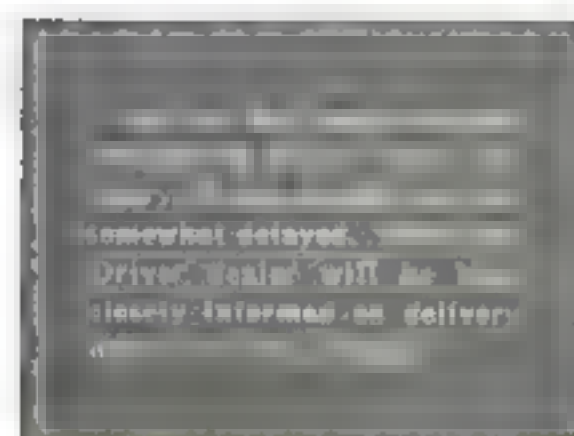
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Send me your colorful folder, giving full details on the Driver Line for 1937.

Name

Address



Walter Winchell On Broadway

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Portrait of a Man Playing the Typewriter.

Overheard: "Nothing makes his head bigger but the bumps he takes for his friends"... A Broadwayite, recently returned from the Coast, was asked how he liked California, to which the reply was "Everything but the climate"... "And what do you think about the climate?" was the query... All the talk about the climate... (side to West Coast correspondents: for their sake, must note me!)... George S. Kaufman, who is in Mary's... the people he writes his scripts for... the kind who keep romantic... are invariably sharp and witty, but often they lack warmth. Kaufman is the bitterest of them all, has an accused of being... to write a good scene!

Tommy... medical... persistent... One point... in from... just in... any Astor story, by offering... home as a... Taylor, named by Mrs. S... Manville... forma... nagerie would be... for... hear... as quiet as the subway.

Broadway's... on... 52nd Street between Vth and Vith Avenue... "21," The Yacht Club, The Onyx, Tony's and... nearly all the nations are represented... All of them are... from the little French table d'hote... (for 60c dinners)!

eat more chow mein than Orientals!... The most fascinating of the cinema shorts, we think, are those sponsored by Popular Science. They're in color and are tremendously diverting. The Embassy features them now and then.

George J. Nathan and other... after with this column, the only pearls they drop are about

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Now
on the
Screen!

COLORING PHOTOGRAPHS

(Continued from page 103)

greens of grass and foliage. Until one is thoroughly familiar with the process, it is better to mix the colors rather light and go over the work several times; however, if too much color is applied, it may be washed off by holding the print in running water for a few moments.

A red brick house will serve as an example because it requires a large assortment of color blends. From the leaflet of light blue, tear off a small piece and dissolve the color in one of the pans of water; then put in a piece of dark blue about half the size of the light blue. Try the color on a piece of white paper to see that it is not too deep. With the $\frac{3}{8}$ -in. camel's-hair brush, begin at the top of the picture and wash rapidly over the sky, gradually fading



All that is needed are three brushes, book of water colors, mixing pans, and blotters

the blue out toward the bottom, or horizon, and blot off.

In another clean pan, dissolve a small piece of scarlet and, beginning at the horizon, work up to the sky, allowing the scarlet to fade into the blue. Unless a sunset effect is required, this scarlet wash should be very light.

The brick will require practice, as sometimes six or seven colors may be required to get exactly the right shade. Brilliant red and foliage green will give the foundation color for red brick. If a lighter color is needed, add a little flesh color and possibly a little light yellow; and for a dark red or tapestry brick, add a little light blue. Using the $\frac{3}{8}$ -in. sable brush, wash over all the brick surface with the brick color, and blot off.

Next the trim, which we will suppose is brown. To get a good brown color, mix brilliant red, dark green, and a little of the warm brown, applied with the No. 1 camel's-hair brush. The dark green so often used on blinds is obtained by mixing dark green with dark blue.

For the grass and trees, mix a piece of foliage green, a piece of dark green, and a little of the light blue. For summer pictures, wash over all of the greens lightly with the same scarlet used for the sky. If, however, the grass and leaves are turning, more scarlet will have to be added. Then mix a little of the flesh color and deep yellow, and go over the lighter leaves with this, bringing them up to a golden yellow. The roadways may be gone over lightly with a wash of brown. Last of all, tint the windows lightly with sky blue.

In painting a number of photographs at one time, apply the sky blue to the whole lot, then the scarlet, then the red brick, and so on.

Portrait coloring is simple, but requires care. For the face, hands, and arms, I do not use flesh color alone, but add just a little light yellow. Wash over all exposed flesh lightly with this color; then deepen it slightly with flesh color and a little scarlet, and go over the cheeks to bring out the color. Add just a little brilliant red and go over the lips. The eyes may be colored blue or brown. For a blonde, go over the hair lightly with light yellow; and for a brunette, brown should be mixed as described before.—D. H.

LIGHTWEIGHT BACK PACK

(Continued from page 65)

22 in. in a person 5 ft. 10 in. tall. The top of each upright is filled with a tight plug of wood having a round top, because the whole weight of the sack is on these tips when in use.

The bottom crosspiece is cut the exact width of the wearer's hips and bent in a gentle curve so that when the two ends are held against the hips, the center of the arc is about 2 in. from the spine. The upper crosspiece is cut about 6 in. shorter and bent so that the center is placed about 1 in. nearer the wearer's back than the two ends. Unlike the lower piece, the convex side of this curved piece is to be placed next to the wearer. This curva-



At the back is a full-length pocket with a slide fastener. Around the sides and bottom are leather tabs for tying on extra articles

ture prevents the frame from interfering with the action of the shoulder blades as does an ordinary pack.

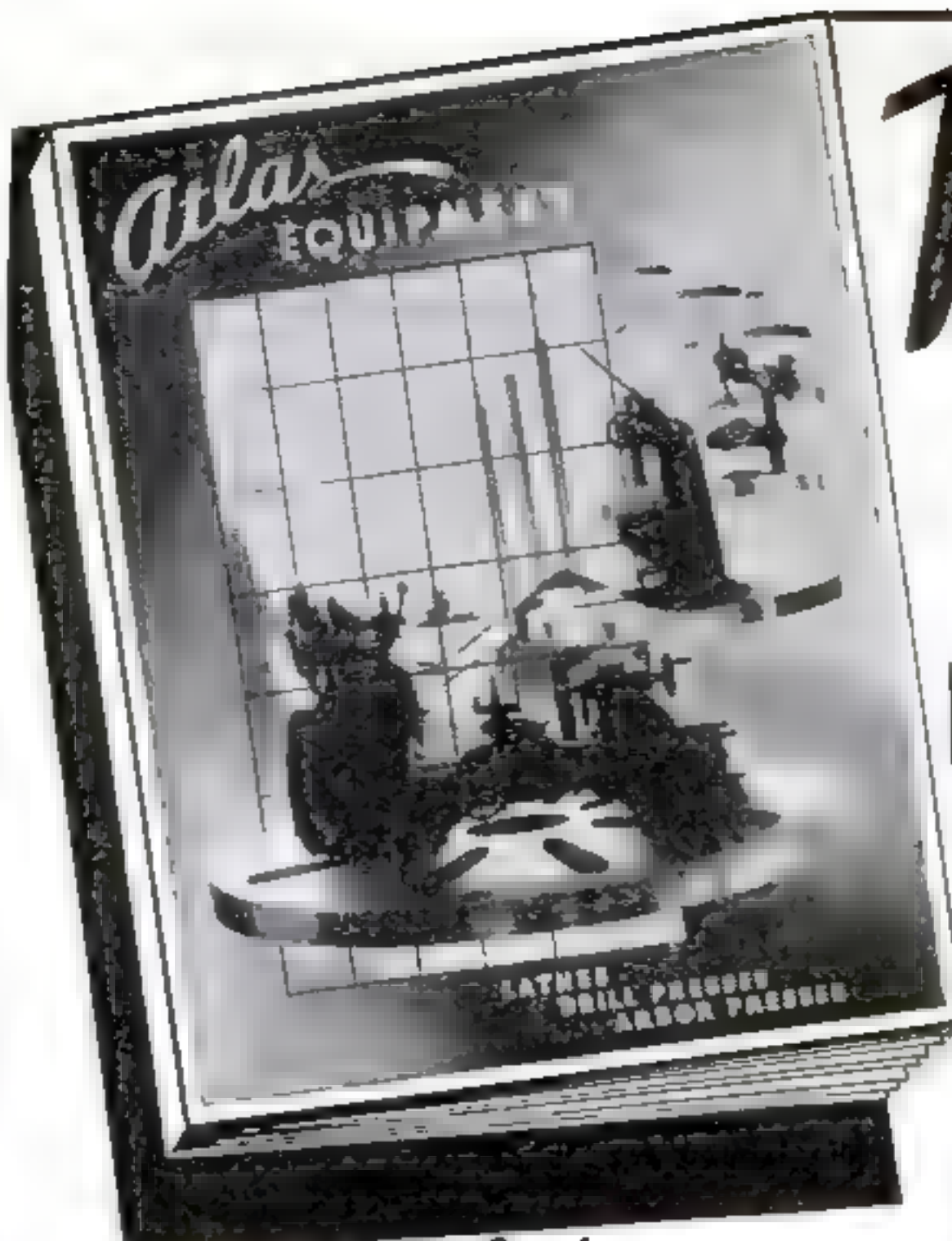
On the bottom side of the upper crosspiece, a U-shaped piece of the smaller tubing is fastened by inserting its ends into holes drilled in the larger tubing, and secured by soldering. This tubing keeps the leather back pad from sliding sideways on the frame.

Four flat straps of aluminum are cut to the pattern given, and the four pieces of tubing are then joined as shown. First the flat pieces and all surfaces to be joined must be "tinned" with aluminum solder. Much more heat is required to melt this solder than the ordinary type.

After the joints have been soldered, holes are drilled and, instead of rivets, short pieces of the smaller tubing are inserted and upset on both ends to form heads, giving additional strength to the joints. An extra crosspiece of the smaller tubing is placed at the point of greatest curvature of the frame to aid in keeping the pack away from the wearer's back.

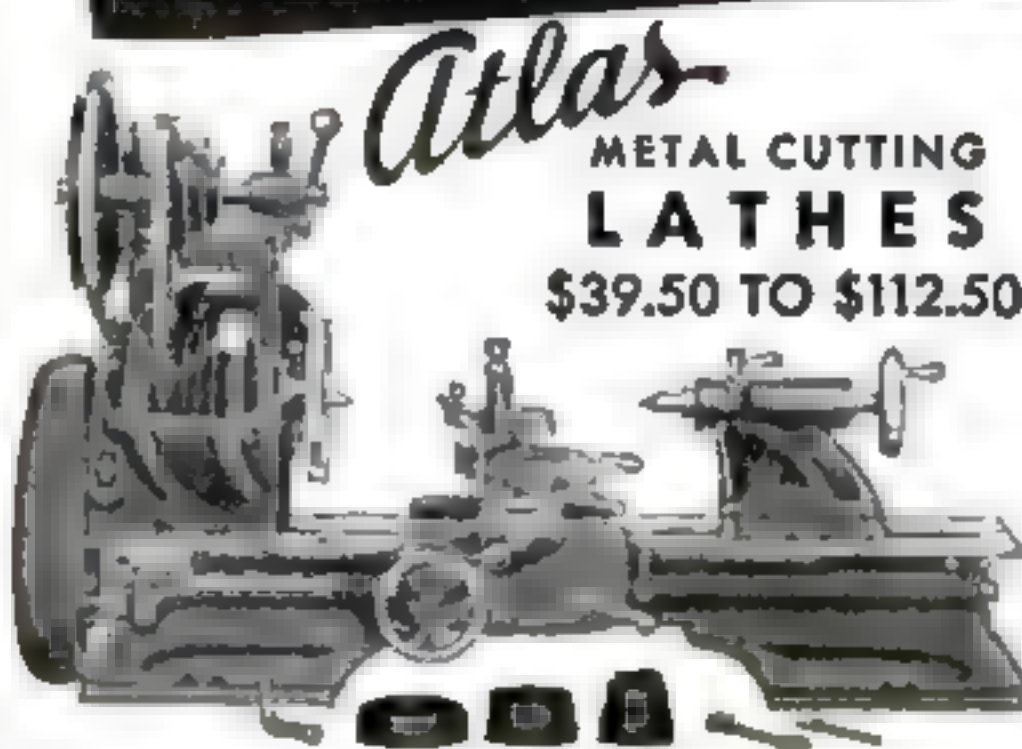
Next, the leather straps are attached. Make the hip strap long enough so that it may be tightened or loosened by a thong threaded through four holes punched in the center.

The adjustment of the frame to the back is quite important. It must have enough curve so that it will not hit the back at any point except on the hips and at the shoulders on the main pad. There is an area between the shoulder blades just below the last projecting vertebral spine of the neck which is quite insensitive and bears loads well. It is worth one's while to find this spot and place the pad over it. The tips of the bottom crosspiece should be lower than the rest of the frame, so that the hip strap will have the proper downward bearing on the hips. (Continued on page 106)



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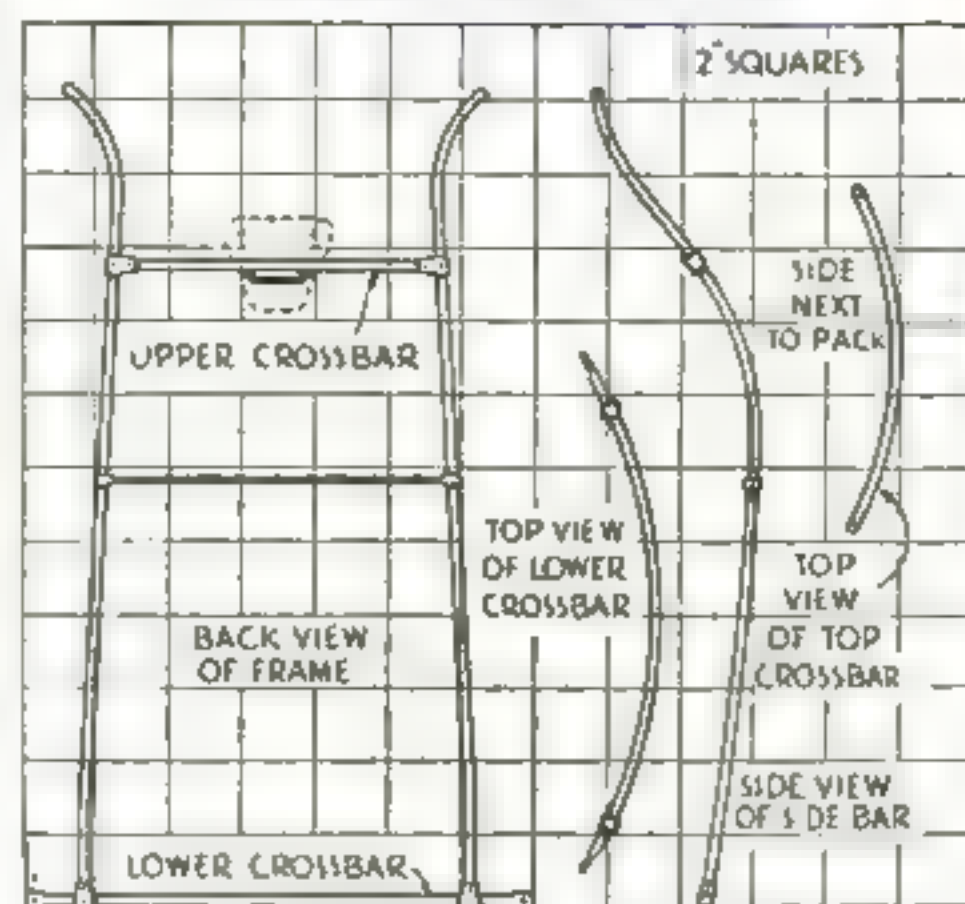
Silver Steel

SAWS



I am also interested in laws for

(Continued from page 105)



In all the seams of the sides and the bottom, extra loops of leather are sewn to enable extra articles to be lashed to the sack if necessary. More pockets may be added if desired. The top of the sack is closed by means of a leather thong, which runs through No. 1 brass grommets set around the edge. The top is made in a semiboxed style so that one fastening string will be enough.

- 6 ft. 7/16-in. O.D. (outside diameter) aluminum tubing with 1/32-in. wall.
- 2 ft. 3/16-in. O.D. aluminum tubing with 1/32-in. wall.
- 1 stick aluminum solder.
- 1 pair leather suitcase straps, 36 in. long.
- 2 yd. waterproof tent cloth, 27 in. wide.
- 1 doz. No. 1 brass grommets.
- 1 pc. 3/32-in. thick grain leather, 8 by 8 in., and 1 pc. 3/16-in. thick sole leather, 5 by 5 in., or miscellaneous bits of leather.
- 1 slide fastener 8 in. long.
- Copper rivets.
- Black cotton thread (No. 12) and suitable sewing-machine needle.

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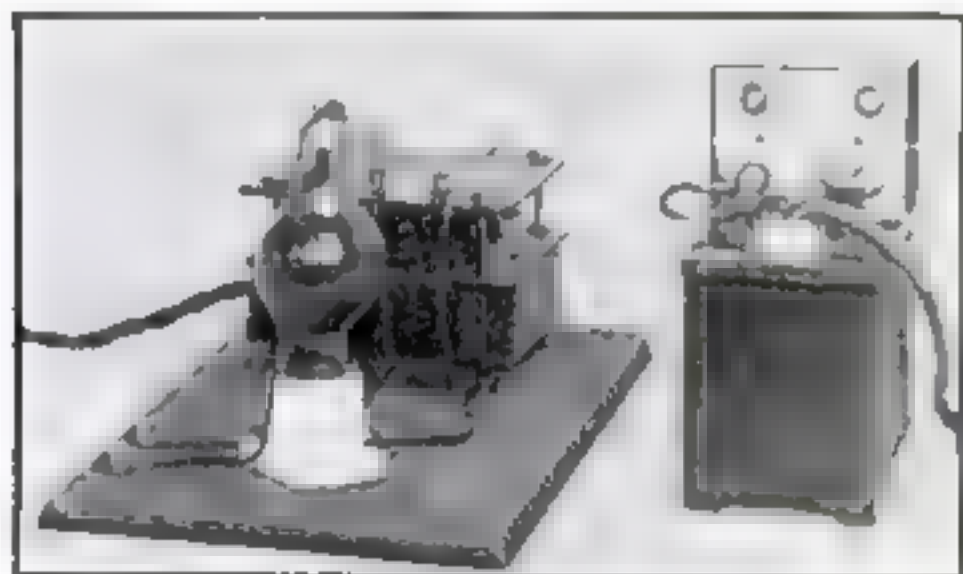
NICKEL BROTHERS, INC., Dept. F. S., Memphis, Tenn.

HOW TO GET CURRENT FOR ELECTROPLATING

(Continued from page 63)

step-down transformer, a full-wave electrolytic rectifier, a voltmeter, and a suitable rheostat.

A full-wave electrolytic rectifier is constructed by securing two strips of aluminum and two strips of iron or lead to a wooden jar top (Fig. 12). The jar selected should be of glass, porcelain, or stone, and must have a capacity of 2 qt. for each ampere that passes through it. No sizes of the metal strips need be given other than that each should have an area of approximately 15 sq. in. to an ampere. Secure the metal strips to the wood with binding posts. Before assembling the top, paint it with asphaltum or acid-proof paint. Lead is preferred for the inside plates, but if not obtainable, iron will serve equally



Discarded chargers of the type formerly used for radio batteries are excellent for plating

well. If iron plates are used, it is advisable to lift the cover and plates from the solution when not in use.

Prepare a saturated solution of water and ammonium phosphate, or water and borax. In mixing the solution, proceed slowly, dissolving a little of the ammonium phosphate or borax at a time until the water will absorb no more. Fill the jar to within 2 in. of the top with the solution and set the wooden top in place.

Before using the rectifier it will be necessary to "form" the plates by connecting a 110-volt A.C. line to the posts attached to the aluminum strips. A 60-watt lamp must be connected in series with one of the line wires. The lamp will burn brightly at first, then gradually grow dimmer until there is a barely perceptible glow. At that point the rectifier is ready for use.

The half-wave rectifier shown in the circuit of Fig. 3 is constructed similarly to the full-wave rectifier with the exception that there is only one aluminum plate and one lead or iron plate. The rectifier is "formed" by the same method outlined for the full-wave rectifier, the connections being made to the aluminum and lead or iron terminal posts.

In order to understand the principle of the electrolytic rectifier, it is necessary to remember that alternating current first flows in one direction through a circuit, then reverses and flows in the opposite direction. As indicated in Fig. 6, the current rises from zero potential at A to a maximum at point B, where it diminishes to zero potential at point C. Then it begins to flow in the opposite direction, rises to maximum potential at point D, and diminishes to zero potential at point E. This complete operation is called a cycle, and the number occurring in one second, usually 50 or 60, is called the "frequency."

Since in electroplating the current must flow in one direction to cause the anode material to be deposited on the object being plated, it can be seen that if we attempt to plate with alternating current, both the plating metal and the object to be plated will alternately act as the anode. Metal deposited from the original anode during half of the cycle will be carried (Continued on page 108)

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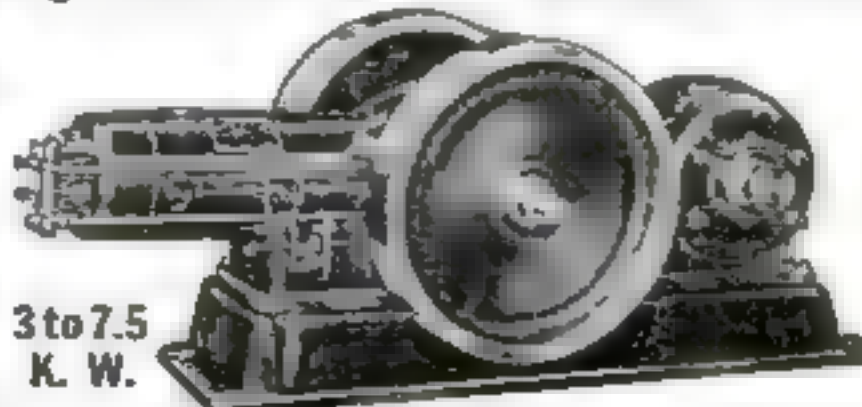
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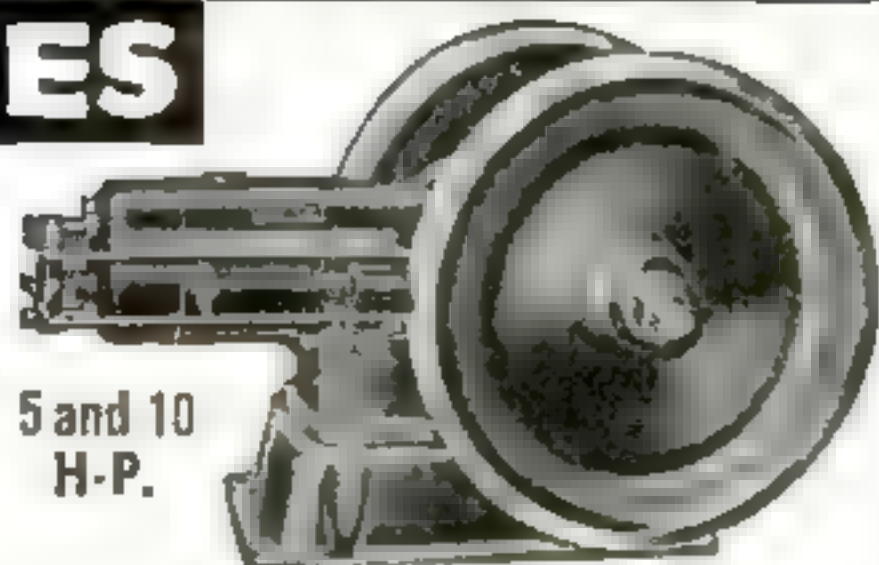
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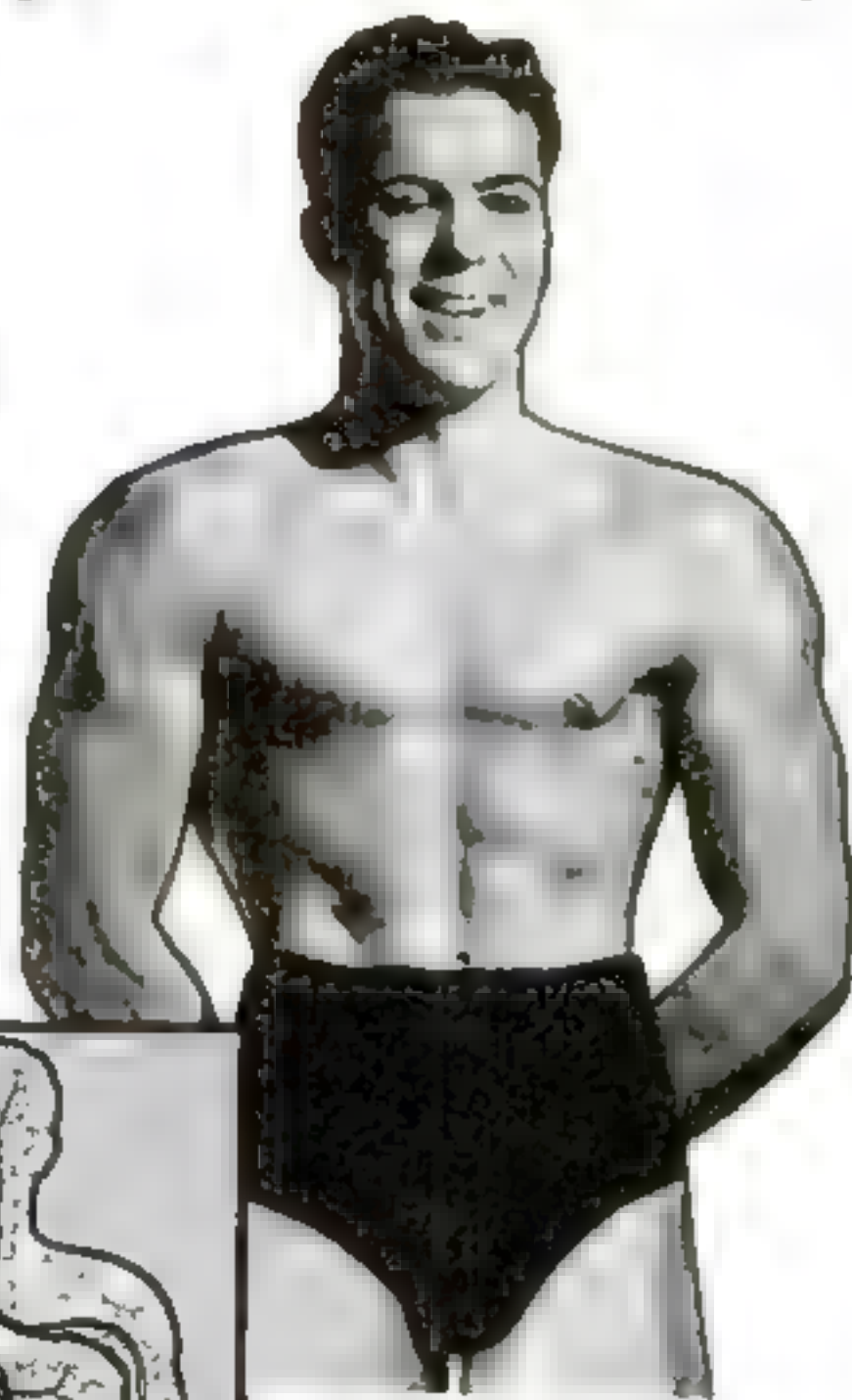


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HOW TO GET CURRENT FOR ELECTROPLATING

(Continued from page 107)

back to it during the last half of the cycle, therefore none will be deposited. If a strip of aluminum and a strip of iron or lead are placed in a solution of ammonium phosphate or borax and connected to an alternating current line through a lamp or resistance, a film of oxide will form on the aluminum strip which will prevent the current from leaving the strip, yet allow it enter from an opposite direction. This principle is used in the full-wave rectifier.

The half-wave rectifier, consisting of a single aluminum plate and one lead or iron plate, is so called because it will rectify only half of the cycle as in Fig. 7.

When the full-wave rectifier is used in conjunction with a center-tapped, step-down transformer, both halves of the cycle are rectified, resulting in a pulsating direct current similar to Fig. 8. The current flows alternately from the lead plate to one of the aluminum plates, then from the lead plate to the other aluminum plate. From each aluminum plate the current flows through the transformer secondary coils in an opposite direction to the center tap of the transformer, where it flows out to the anode of the plating tank in one direction (Fig. 4).

Other rectifiers suitable for electroplating are the types used for charging radio batteries before the all-electric set made its debut. Among these are the kind that uses a gaseous bulb containing a plate and a filament (Fig. 5); and the copper-oxide type, which consists of a series of specially treated copper plates.

A transformer for use with either the electrolytic rectifier (Fig. 4) or the battery-charger type (Fig. 5) should have two secondary windings, each delivering 6, 8, and 10 volts. Detailed instructions for making a transformer will be given next month.

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A USEFUL method of protecting any metal object except aluminum from rust is to give it a coating of solder or zinc. The solder or zinc can be heated in an iron ladle, and the part to be coated, after being thoroughly cleaned, is thrust into it. Several particles of zinc chloride or ammonium chloride (sal ammoniac) laid on top of the molten metal will serve as a flux. The object can also be dipped into "killed" acid or a solution of zinc chloride before it is thrust into the solder. After taking it from the molten bath, throw the object on the bench or floor so the excess metal will be removed by the impact.—R. B. W.



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RETURN OF THE ICE AGE

(Continued from page 53)

ward. The theory thus accounts for what actually occurred—and for what may occur again.

Drayson estimated that the length of time required for this gradual sway of the earth's axis to take place (from a minimum of twenty-three and one-half degrees to a maximum of thirty-five degrees) is about 15,878 years.

Since our globe's axis is now nearly at its minimum slant, we can, according to Drayson's theory, determine the time of the last glacial period by figuring backward to the last period of maximum inclination.

We are now roughly at the year 2,000 A.D.—or at least we shall be in a single lifetime, a mere nothing in astronomical time intervals. Count backward 15,878 years and you arrive at 13,878 B.C. At this time, says Drayson, the glacial period was in full swing in the Northern Hemisphere, and in the Southern, too, of course.

IN THIS far-away epoch, over 2,000,000 square miles of Europe and 4,000,000 square miles of North America were covered with a great sheet of ice, which was in some places over a mile thick. In New England, the glacier came as far south as Cape Cod, which was actually formed from the rocks and soil pushed ahead of the ice wall. This is also true of the Dongan Hills, on Staten Island, New York City.

The southern edge of the ice extended westward along the border of New York State, across northern Ohio, and as far south as the present site of Indianapolis. In Europe, it covered the British Isles, and parts of Germany and Russia. If Drayson's theory is correct, we may expect that many future cities of North America and Northern Europe will again be obliterated by the oncoming ice when the next glacial age reaches its peak at about the year 18,000 A.D.

TOOTH-STAINING WATER CLEARED BY FILTERING

FLUORIDE, a chemical compound that discolors teeth and is found in some city water supplies, can be removed by filtering the drinking water through a new material called "defluorite," states a recent report of the Kansas State Board of Health. Field tests were made in Chepota, Kans., a town whose children have discolored, black or brown teeth from drinking fluoride-containing water from the city reservoir. By filtering and re-filtering the water through the defluorite material, it is stated, all traces of the discoloring chemical can be removed without impairing the taste.

REAMED ORANGE JUICE HAS MOST VITAMINS

TO OBTAIN the highest possible vitamin content, orange juice should be extracted by reaming rather than by merely squeezing the fruit, according to a recent report of citrus-fruit research. Reaming the orange down to the albedo, or white layer of orange skin, the report states, ruptures the juice sacs and produces a juice ten percent richer in vitamin C than that extracted by squeezing.

FIND ACID IN SPINACH HARMS CALCIUM DIET

Good news for many children is contained in the recent announcement by Michigan scientists that spinach is not as good a health-building food as has formerly been thought. Spinach, the statement explains, contains oxalic acid, a chemical which affects the needed calcium in the diet, turning a part of it into a form which the body is unable to use. This offsets some of the vegetable's beneficial effects.

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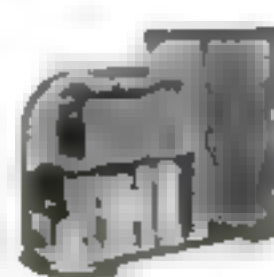
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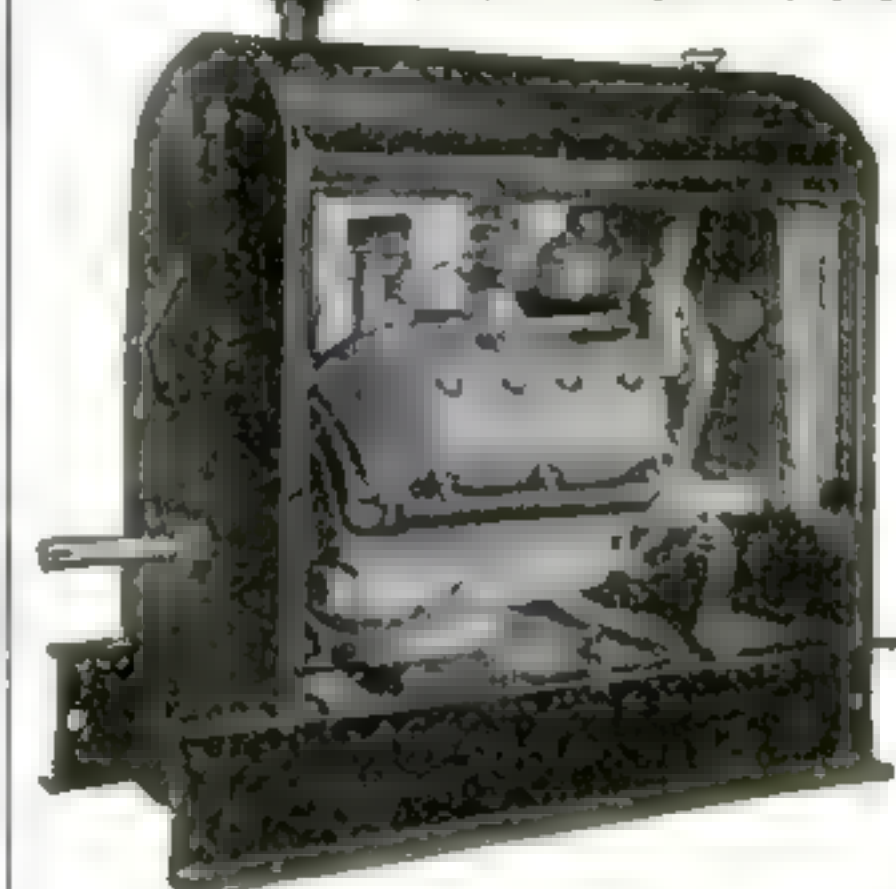
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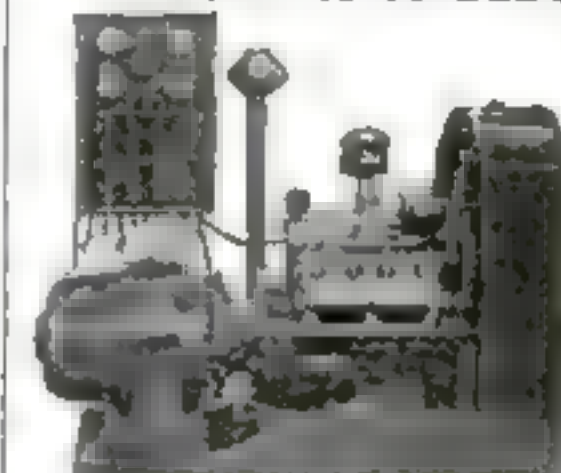
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When I was twenty-eight, I got the idea of studying law but it was three months before I could figure out how, because I could not attend a law school or university. Yet I did study law, pass the Bar examinations and today have a successful practice... thanks to home study. The only help I received was the loan of the necessary law books from attorney friends of mine. In fact, every one discouraged the idea; did not think I could accomplish such a great undertaking by myself.

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I am now actively practicing law and one of the interesting things about it is that my other home studies, which have given me technical knowledge, have been most helpful.

Personally, I do not think that I have accomplished anything which any other person could not do. People can accomplish anything they wish if they will just put forth the necessary energy. The basis of my own accomplishments was the training I received in the study of correspondence courses; the training to teach myself.

—A.J.B., Higginsville, Mo.

AGE HAS NO BEARING ON HOME STUDY

I retired from the Medical Corps of the U.S. Army after thirty-eight years' service, through all grades from First Lieutenant to Colonel. Nearly eight years of that time were spent in the Philippine Islands in three tours. I also made a trip to Cuba and during the World War I commanded Mars Hospital Center, one of the largest in France.

I am thoroughly sold on home study and in the belief that perhaps the experiences of an old man might help some of the youngsters over a long and difficult trail, I am submitting herewith "What Home Study Has Meant to Me".

Only a comparatively few years ago, it was generally accepted that if one had finished a high school course, or particularly if he had graduated from college, his study for life had been completed. But more recent years have changed this view and it is now generally conceded that if a man is to keep along with the developments of his calling, he must study more or less constantly. As most of us must devote the major part of our time to the prosaic routine of earning a living, there is not much opportunity to return to the institutions of learning to get the necessary refresher courses, and it is in this field of assisting the ambitious students who cannot leave their work, that home study has proved so valuable.

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Secrets of Success

My own experience in the field of home study and correspondence courses has been quite extensive. Soon after graduating in medicine I felt the need of a knowledge of German and undertook a correspondence course in which a phonograph was used. This I found of great value and later I bought the Spanish course from the same school as a knowledge of that language was helpful while in the Philippines. French, acquired largely through the use of the phonograph, was most useful to me during the War.

Some years ago while in charge of a hospital in a western city there was comparatively little to do in the severe winters, and a better knowledge of chemistry was desirable. For some time I worked at this alone but so much time was consumed in searching literature for the material I needed, that I again registered with the same school for their course in chemistry. Here I found what I had been in search of, as in one little booklet was collected much of the material that I had hunted unsuccessfully for over a considerable time. This course also proved of great value to me.

We are likely to think of students as youthful, and so most of them are, as we see them in the great institutions of learning. But back in the quiet of thousands of homes men and women are intensively perusing interesting and valuable courses of mental training, and age has no bearing on this study.

After retirement from active life, this form of study offers much to compensate for the loss of accustomed occupation. The writer has retired but much time is filled in writing popular and technical articles, and in teaching. In this work the need of illustration is frequently urgent. It was both difficult and expensive to have an artist make these drawings, so I searched the columns of POPULAR SCIENCE, of which I have been a reader many years, and enrolled in an art school besides buying two sets of art lessons.

This study has developed an entirely unsuspected latent talent for drawing, and has enabled me to do my own illustrating. It has also proved of great value in rapidly illustrating on the blackboard portions of lectures to my students. As I have been fairly successful in the marketing of the articles mentioned, I feel that the home study and especially the assistance of correspondence courses have contributed much to this success.

These are only illustrations of life-long utilization of home study opportunities. If one wishes to improve or excel along any line, and cannot get the necessary personal instruction, I know of no better way than to utilize correspondence teaching and home study. The chances are that he will find exactly what he needs in this varied and valuable field of education.

—G.A.S., Berkeley, Calif.

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Good-Looking Doors

FOR BUILT-IN FURNITURE

HERE are four suggestions for making attractive small doors for cupboards, cabinets, and various types of what is usually referred to as "built-in" furniture—pieces made to fit a certain place.

Flat doors, hung flush, have no dust-catching projections like the ordinary paneled variety. They may be cut from 13/16-in. five-ply wood or framed together and sheathed with thin plywood, glued and bradded on. Paneled doors already in use can often be sheathed over in the same way. A striped or stenciled border takes away the severity of the plain surfaces. Decalcomanias or transfers also can be used as decorations.

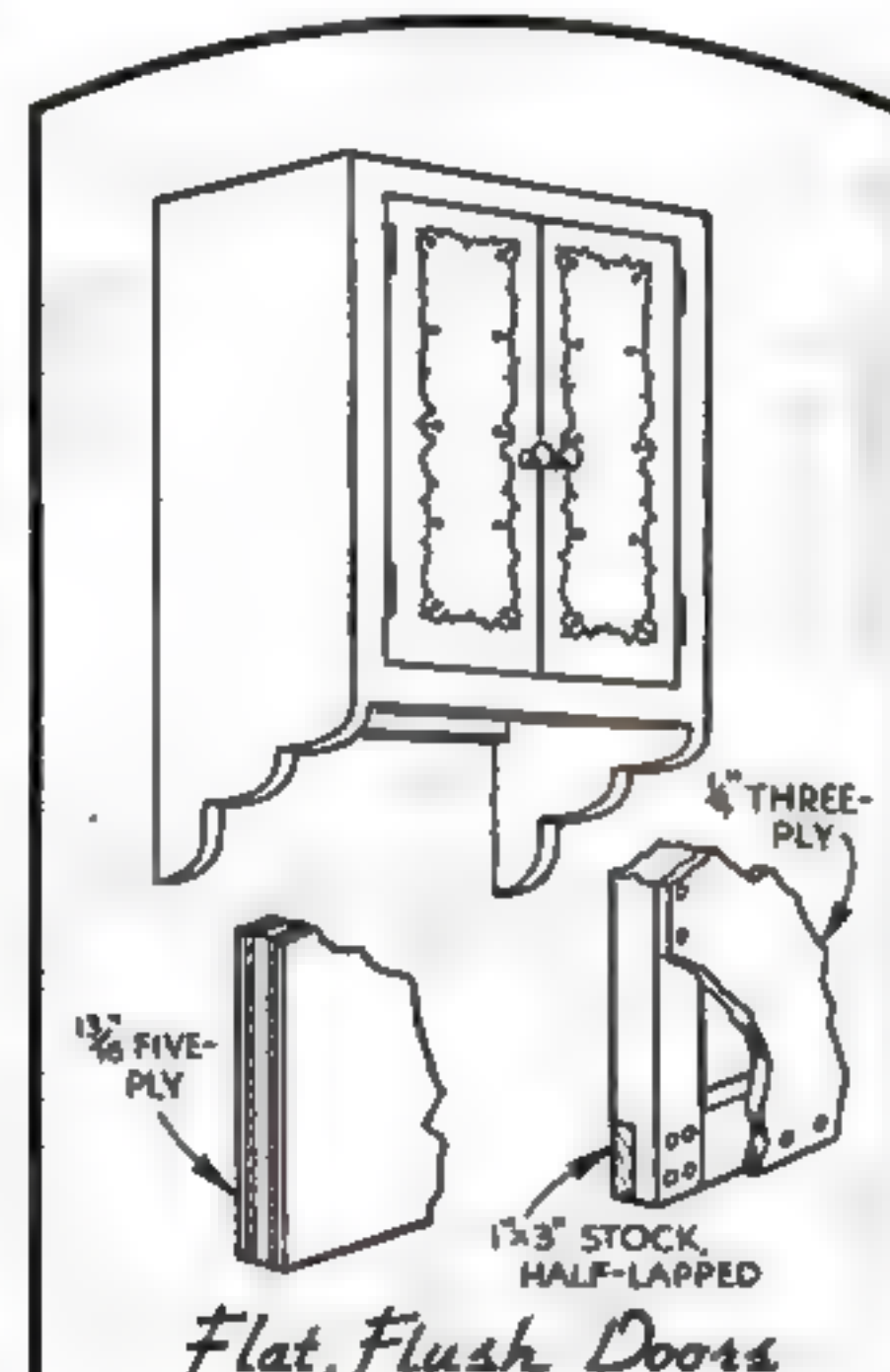
By
Leslie Kinning

An antique corner cupboard of unusual charm is pictured in one of the drawings. The lower doors consist of boards of random widths screwed to cleats. The wood is

"checked" by slashing it with a V-chisel. The screws in the lower doors should be counter-sunk and hidden with plugs projecting 1/8 in. After the cupboard is enameled, paint of a contrasting color is rubbed into the checks, and then rubbed off the surface with a cloth.

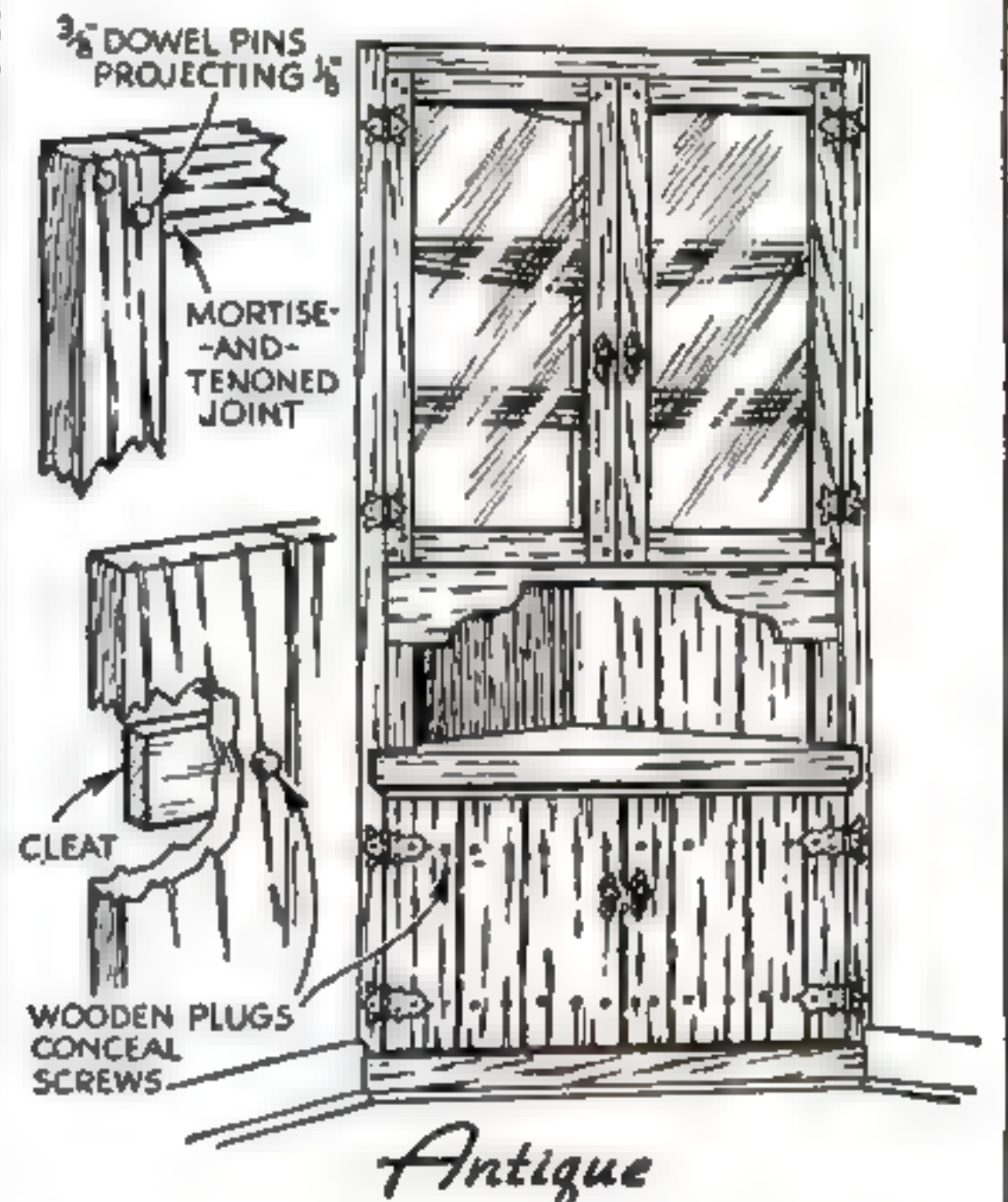
Half spindles can be used to make a door of Spanish or Italian design. In order to clean the glass, it should be mounted in a separate frame held in the rabbet with turn buttons.

Lip doors, shown in the lower right-hand corner, do not need close fitting. The sheathing projects 1/4 in. all around, hiding the joints.



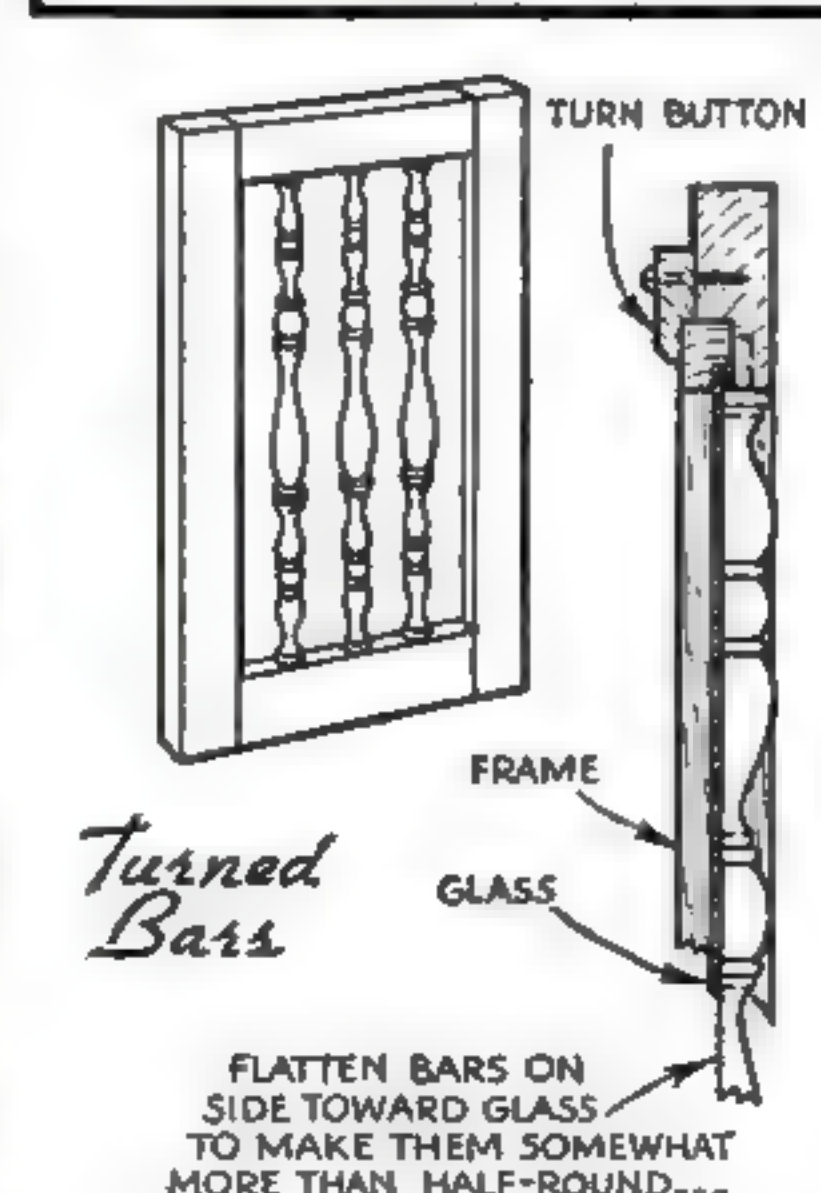
Flat, Flush Doors

By hanging your doors flush, all dust-catching projections may be eliminated. The severity of the plain surface is broken by borders



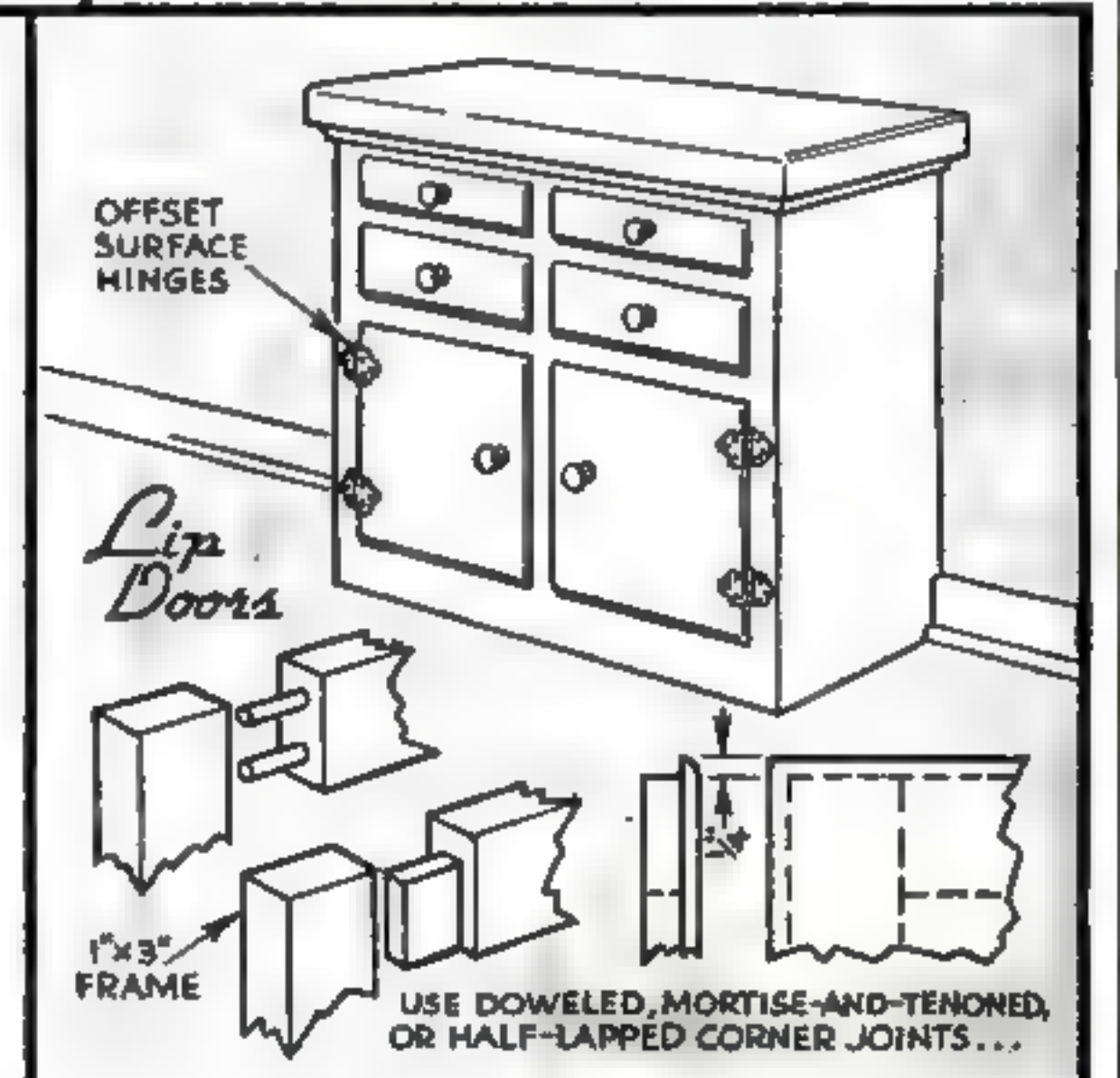
Antique

Random-width boards screwed to cleats form the lower doors of this corner cupboard. The wood is slashed with a V-chisel, and paint of a contrasting color is rubbed in the checks



Turned Bars

FLATTEN BARS ON SIDE TOWARD GLASS TO MAKE THEM SOMEWHAT MORE THAN HALF-ROUND...



Lip Doors

USE DOWELED, MORTISE-AND-TENONED, OR HALF-LAPPED CORNER JOINTS...

TRAPPING COSMIC RAYS

(Continued from page 15)

Texas plains, making tests in a raging blizzard among the Rockies, lowering lead-lined boxes of instruments into the water of snow-fed lakes in the Sierras, he followed one clue after another. The mystery rays, he found, could penetrate the equivalent of seventy-three feet of water. Using this as the basis of computations, he calculated the wave length of a cosmic ray is approximately 10,000,000 times shorter than that of light. It would take a billion such wave lengths to equal the thickness of one cigarette paper!

Four years ago, Dr. Compton organized an international survey in which coordinated expeditions made studies in all parts of the world. Later, automatic instruments circled the globe on steamers, recording cosmic radiation. And, recently, gigantic balloons, here and abroad, have carried scientists to the roof of our atmosphere where their instruments obtained additional data.

AN INNOVATION in high-altitude research started a few weeks ago in Texas. Dr. Millikan, still plumbing the upper sky with sounding balloons, began releasing tandem gas bags. Four or more of these strung together carry self-recording instruments to a height of from seventeen to twenty miles. Designed by Dr. Victor Neher, one of Dr. Millikan's assistants at the California Institute of Technology in Pasadena, the compact instruments include a clock, a camera, a cosmic-ray electroscope, a thermometer, and a barometer. Their total weight is only two pounds. In the thin air at the top of the ascent, the balloons burst and the instruments float to earth by parachute.

To get above the lower layers of the atmosphere, an expedition recently carried tons of equipment across deserts and rivers and mountains from Pasadena to Pike's Peak in the Rockies. Heading this scientific trek was Dr. Carl D. Anderson, noted for his discovery of the positrons, one of the invisible "building bricks" of which all matter is composed. At the top of the Colorado mountain, Dr. Anderson assembled his apparatus and snapped some of the most amazing pictures ever taken. They showed the flying fragments of an atom shattered by cosmic rays!

At the California Institute of Technology laboratory, this research worker took eleven other pictures showing the same thing. The dream of the Dark Ages—the transmutation of metals—was actually taking place before the lens of his camera.

As everyone knows, particles of the different elements are composed of billions of molecules which are, in turn, composed of atoms, or groups of electrons clustered about a positive core, or nucleus. In any one element, such as lead, every atom has a certain number of electrons. If it loses or gains a single one, the atom is so modified that it is no longer lead but becomes some other element. So, when the cosmic ray blasts electrons from the atoms of one element, it changes these atoms into another element.

AS EFFECTED at present, this change is only temporary since the lead immediately begins to expel other electrons and to rearrange those left behind, so that each atom again contains just the right number. At some future day, however, science may learn how to make the transformation permanent and so harness cosmic rays to the work of producing elements at will.

Just as sensational is another discovery made at the California laboratory—the creation of tangible matter out of light and cosmic rays!

Some years ago, two scientists in the Cavendish Laboratory, at Cambridge University, England, proposed (Continued on page 116)



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HOTEL CLEVELAND

POPULAR SCIENCE MONTHLY

AMATEUR EXPLORERS MAKE NEW DISCOVERIES

(Continued from page 27)

James W. Gidley, Smithsonian workers removed the skeleton of the prehistoric giant. Millions of years ago, the mammoth plowed through southern marshes, towering twelve feet in the air and carrying tusks ten feet long.

While luck often aids in such discoveries, the amateur who takes his exploring hobby seriously does not depend upon chance. The more he knows, the more likely he is to recognize the important and the new. For this reason, many beginners are taking special training or are joining organizations to broaden their background.

AS THIS is written, one such group is studying the rock formations of south-eastern Wyoming and western Colorado, learning what to watch for and what stories the different strata have to tell. A training school for young explorers, under the direction of Prof. Ralph L. Belknap, leader of the last University of Michigan Greenland Expedition, is now a feature of that Michigan institution. In Canada, an organization of young mountain explorers, the Alpine Club of Canada, is scaling difficult peaks and examining the upper layers of rock. England has its Oxford Arctic Club and its British Public School Exploring Society.

Can you imagine anyone with fewer opportunities for exploring than an inmate of a penitentiary? Yet, one prisoner at Canyon City, Colo., made a discovery of intense interest to paleontologists a few weeks ago. While excavating for an addition to the institution, he unearthed two fossil teeth unlike any previously discovered. They are thought to be the only remains of some huge and ferocious fish inhabiting prehistoric seas that once covered the state of Colorado.

At Seaford, Long Island, N. Y., a remarkable home natural-history museum has been assembled by Jay T. Fox. It contains more than 8,000 specimens, illustrating the advancing stages of life on earth. For twenty years, Fox has been collecting animals, plants, and minerals on trips and walks in spare-time hours. A few months ago, he discovered a piece of lignite, or brown coal, at the bottom of a clay pit worked by a local brick company. The interesting thing is the fact that the coal bore the marks of teredos, or shipworms. As these creatures live only in salt water, the find established the fact that the prehistoric shoreline of Long Island lay more than a dozen miles north of the present coast.

ON THE Pacific Coast, several islands in the harbor at Santa Barbara, Calif., are being turned into an open-air library of fossils. Since 1916, a local physician, Dr. Asbjorn P. Ousdal, has been exploring the seacoast and the mountains of the vicinity, assembling a collection that covers 300,000,000 years of the earth's history and tells of prehistoric whales equipped with feet for walking, of fan-plumed lizards, of giant sloths, and of dinosaurs as big as a truck and trailer combined.

Whenever Dr. Ousdal discovers a specimen, he cleans it carefully, coats any tiny cracks with shellac, and pastes bits of rice paper over small bones to prevent their shattering.

To aid such amateur archaeologists, the National Research Council, in Washington, D.C., has issued a guidebook of instructions, telling how to proceed in the work of excavation. Here are a few of the tips it has to offer:

When removing a specimen, never pull it from the earth. Always dig carefully around it, using thin, dull knives, orange-wood sticks, and brushes. Give each specimen a number, and record the number and the position of the object in a notebook. Copy all notes, drawings, and pictures in duplicate and keep one set in a safe place. (Continued on page 118)



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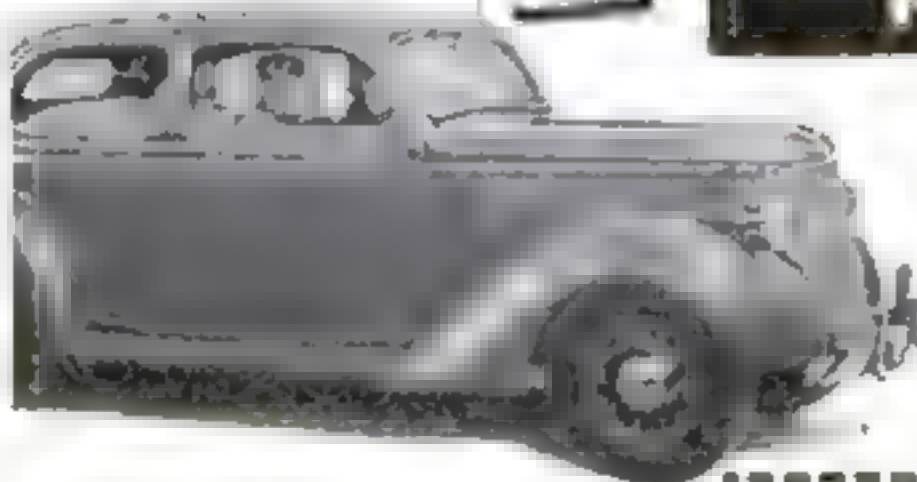
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AMERICA GROWS DATES IN DESERT ORCHARDS.

(Continued from page 23)

to pollinate fifty or sixty female trees.

Date trees bloom in early spring, and when the heavy stalk begins to split, the time for pollination has come. As I strolled through the aisles of this desert Eden, cork-helmeted men already were climbing tall ladders into the hearts of the trees. Each carried a huge, wide-bladed knife and wore at his belt a fruit jar full of pollen-dipped puffs of cotton. Grasping a stalk, he slit it, exposing long strings of maize-like blossoms inside. Carefully he dusted them, sifting the yellow powder so it would reach each bud. Then, to make doubly sure, he placed the puff in the middle of the bunch and tied the cluster tightly shut. Since each blossom must be touched with the yellow dust before the sap is dried, and one female palm produces eight to twenty blooms, a like number of trips into each tree is required in order that all may be pollinated as ready.

WHEN the young dates reach the approximate size of a large olive, it is time for thinning. Charts indicate how many each tree will carry. A typical tree will carry about 900 dates to the bunch, and its eight to twenty bunches will average from 100 to 300 pounds of delicious fruit.

Near Indio, Calif., is an unusual date ranch, run by a man who took it over when others had failed and made it the largest mail-order enterprise of its kind in the world. E. F. Shields, the owner, says each of the 119 trees in his garden is just as distinct in its individual characteristics as a child.

Unlike other trees, the date palm's trunk does not increase in diameter with age, but shoots upward at the rate of about two and a half feet each year until the tree reaches middle age, when the rate falls off somewhat. Eventually, Shields will have to climb 100 feet, or ten stories, to pick them, and some doubtless will still be harvested at 300 years hence.

Through the hot summer months, the young dates store up sweetness. By the middle of August, they have reached maturity and hang in long, heavy clusters on the trees. Now another strange paradox: although enough water is poured onto these desert acres during the year to flood them ten feet deep, the thirsty tree's worst enemy is rain; for raindrops, falling on the delicate dates, would cause their thin skins to burst. Up the ladders go men with large waterproof bags which they tie tightly over the huge clusters, protecting them against birds and dirt as well as untimely moisture.

Dates ripen between the middle of August and Christmas, and a prolonged and tedious job now awaits the harvester, for although the dates hang in huge clusters, like bananas, they must be picked by hand, one at a time, as they ripen. Again and again the skyscraper trees must be climbed until the entire crop is harvested.

AS AUTUMN draws on, a golden stream begins to pour into the Indio packing plant of the California Date Growers' Association, a coöperative organization to which belong a majority of American date raisers. Trucks, piled high with dates in twenty-pound boxes, discharge their cargoes and receive, in exchange, weight tickets according to which they will share in the receipts of the crop. Now commences a long and intricate process whereby the fruit is processed by a method that makes American-grown dates cleaner and superior in flavor and quality to any others in the world. As the boxes are dumped onto endless belts, their contents move toward the cleaner and sampler where powerful fans blow out dirt and dust. (Continued on page 120)

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AMERICA GROWS DATES IN DESERT ORCHARDS

(Continued from page 119)

One tenth of the fruit is caught by a slot which leads it off for sampling. Sharp-eyed girls divide them into four grades and the culls, for quality varies largely with the age of trees, kind of soil, variety, amount of fertilizer and water applied, and the general skill of the grower. According to this sampling, the grower is paid for his fruit.

PASSING through brush-lined cylinders that scrub them vigorously, the dates now are dry-cleaned and polished, and next fumigated in double-walled rooms filled with ethylene oxide gas, which kills any bugs that may be on the fruit. A battery of whirling cylinders next carries the dates through the grading machine, where soft rotating brushes clean them. Discharged onto a moving rubber belt, they pass before other keen-eyed girls who sort them for packing. Small ones are dismissed as culls and used chiefly for by-products. Moisture content is adjusted by a process in which tons of water are added or removed to bring the dates to perfection. Wet ones go to a room where a moving current of air dries them, while dry ones are hydrated by rising clouds of steam. Immature dates go into chambers where heat, controlled by thermostats, ripens them to full sugar content. Maturing here instead of on the tree, they do not become wrinkled like prunes, but keep their smooth, glossy skin.

In an adjoining laboratory, chemists constantly are testing fruit samples, distilling out the water and measuring it to ascertain the moisture content; testing the sugar content, and making sure that every date meets the standard set by the association.

Having passed through this long process and reached perfect condition for shipment, the dates are packed again by machinery. Hand-packed into small cartons like strawberry boxes, they are fed into a machine where transparent wrapping material, printed with thousands of labels, unwinds from a whirling roll. As the wrapper encircles the box, a small round spot forming part of the label's design interrupts a pencil of light, and an electric eye stops the machine; the wrapper is cut and sealed, and the box delivered down the chute. Turning out filled boxes at the rate of thirty-four a minute, this machine handles a freight car of dates every sixteen hours.

A large proportion of the date crop goes out in fifteen-pound cartons. Little dates pass into a huge, long-barreled machine resembling a big telescope, which seeds them and prepares them for fruit candy, date bars, and other uses. Last year, the Indio plant put out 2,500,000 pounds of dates, but as yet this domestic crop was only a small part of the 55,000,000 pounds consumed in this country.

EXPERIMENTS by date growers recently have added new foods to the American menu. Dried and pulverized dates look like bread crumbs and are used in cereal instead of sugar. Transformed to resemble corn flakes, they make a delicious breakfast food, eaten with cream but no sugar. The varieties produced in America vary in flavor and texture from the large, soft, moist date that almost melts in one's mouth, to the bread date, dry in texture and possessing a nutty flavor. Some varieties contain as high as sixty percent of sugar.

Romance still clings to the Americanized date, for leading varieties bear ancient names such as Deglet Noor, the "date of light"; the Thoory, or bread date, from Algeria; and the Dairee ("cloister of a monk"), from Mesopotamia. But science has transformed the bread of the Sahara into a brand-new creation, a delectable food as new as a streamline locomotive or the latest creation of the test tube.



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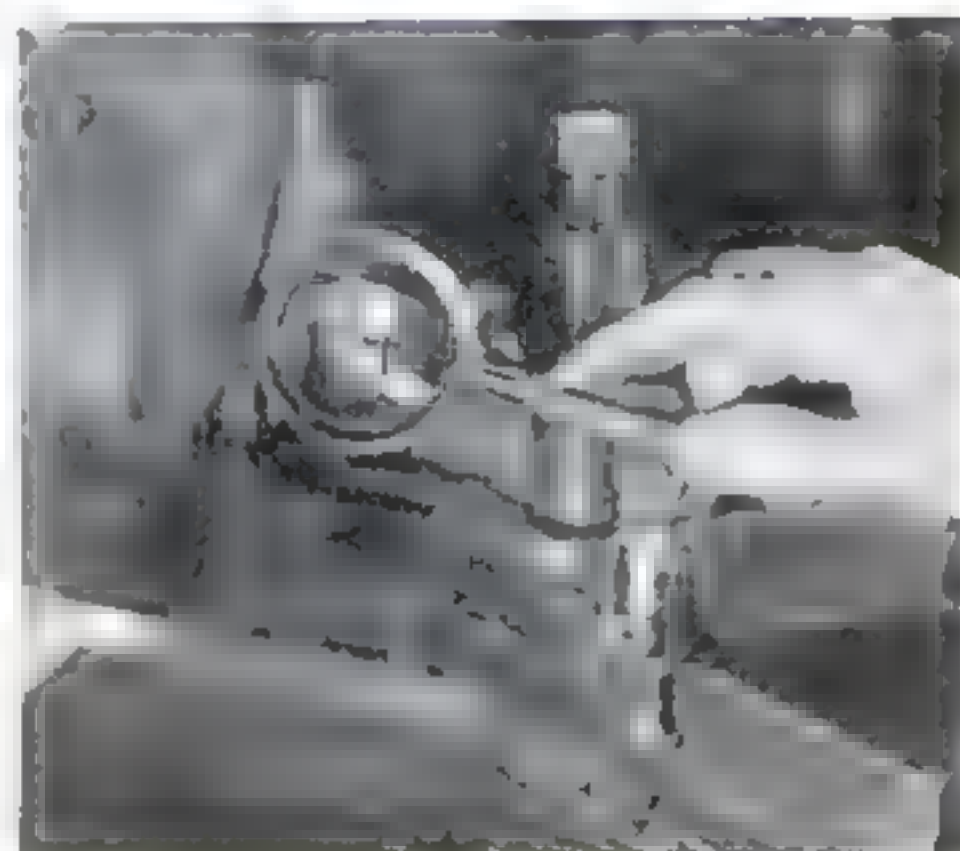
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(Continued from page 49)



A hand magnifying lens attached to a lathe carriage with a ball-and-socket tripod joint

and eyepiece and arranging a hole in the side of the mounting for light to enter, most shop inspections can be made with light coming at an angle, from a source above and to one side of the stage. A small automobile spotlight operated by a suitable transformer or battery makes a satisfactory illuminator. It is placed so that the brightest spot is focused on the metal specimen, at a point directly below the objective.

One of the drawings shows the construction of a vertical illuminator for use with a microscope that has an objective lens that can be unscrewed from the microscope tube.

Metals resemble woods in that they have characteristic structures. These crystalline structures are used in metallurgical laboratories for identifying unknown alloys, for determining the effect of heat treatments, and for learning other inner secrets of metals. Although the home craftsman usually does not find it necessary to go into the crystalline structure of alloy steels and other metals, the amateur microscopist who is also a metal worker may find it interesting to know how specimens are prepared for microscopic examination.

FIRST, it is necessary to give the metal to be examined a very high polish. This can be done by grinding the specimen flat with a fine-grained wheel, honing it on first a rough and then a fine-grained razor hone, polishing it with successively fine grades of abrasive powder, and ending up with optical rouge or some other polishing agent that produces scratches smaller in diameter than the length of a light wave. Polishing powders are held in "laps" made by tacking pieces of cloth to blocks of wood, moistening the cloth with water, and sprinkling it with the abrasive powder. A different lap is used for each grade.

After a polish is produced, which reveals no deep or wide grooves when examined by the microscope, the metal is ready for etching. There are a great many etching agents in use. These include a mixture of ammonia water and hydrogen peroxide, for brass; a five-percent solution of silver nitrate in water, for lead-tin alloys; a two-percent solution of nitric acid, for cast iron; concentrated nitric acid and ammonium persulphate, for steel; picric acid in methanol, for steel; equal parts of hydrochloric acid and water, for revealing fractures in steel; and various concentrations of nitric acid in water, for steel.

After the etching solution has acted, wash the specimen in water, and, if an iron alloy, dry it as rapidly as possible, in order to avoid oxidation. Examine it with the aid of a vertical illuminator, if you have one. Otherwise, arrange the light so that it strikes the specimen as nearly as possible at right angles. Minute fractures (Continued on page 122)

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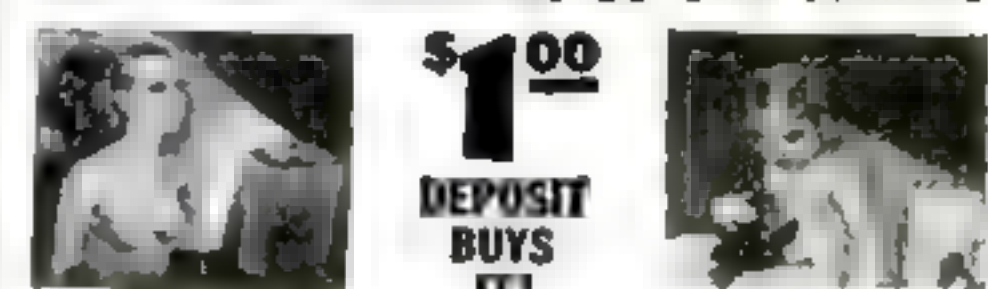
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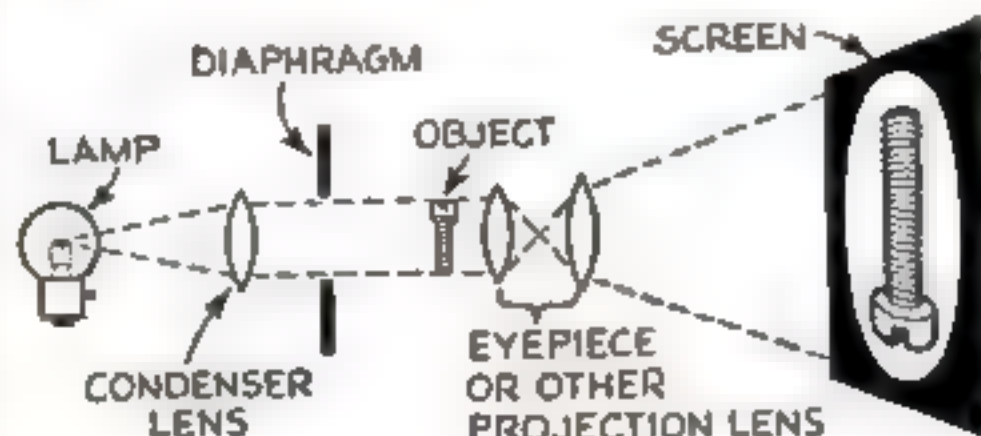


USING YOUR MICROSCOPE AS A SHOP TOOL

(Continued from page 121)

in steel, copper, and various other metals can be examined with the microscope at moderate powers. Usually, such tiny cracks in steel can be revealed by etching for ten to twenty minutes in a half-and-half solution of hydrochloric acid and water.

The edges of such tools as lathe bits, carving chisels, metal engraving tools, tiny drills, razor blades, and a host of other cutting instruments can be examined easily with the aid of a microscope. Usually, a magnification of ten to fifty diameters is adequate. The tools can be illuminated by light coming from behind them, so that their edges are seen in silhouette; or they can be illuminated from



Your microscope can be used as a projector by setting the object in the position shown here

above or at an angle, so that surface details near the cutting edge are seen. It is best to use both methods when possible.

In the laboratories of automobile manufacturers and other concerns using cellulose lacquers or paints, microscopic examinations are made to determine the wear and weathering properties of the finishing materials, and to check their uniformity. Examination of a painted surface after it has been in use for a time may reveal surprising facts about its condition. It might look perfectly smooth and intact to the eye, yet be shown by the microscope to be broken up by a network of fine cracks that render it worthless as a protective covering.

Another important industrial use for microscopes is in making precision measurements. Professional-type microscopes like those found in a well-equipped biology laboratory can be provided with special micrometer eyepieces with which accurate measurements of diameters and lengths can be made.

The amateur microscope can be converted into a crude but effective measuring device for small objects by mounting on its stage a machinist's micrometer in such a way that turning the micrometer screw moves the object laterally. One possible way of doing this is illustrated. The object is supported by a platform of sheet metal that moves sideways against the action of the micrometer. The amount of movement is read on the micrometer scale.

IT IS necessary to equip the microscope eyepiece with a marker that is set at the point on the object from which measurement is to be made. This marker can be a bristle from a camel's-hair brush, cemented with a drop of balsam at a point in the eyepiece where a sharp image of it will be seen; or it can be a strand of spider web. This point usually is in the plane of the diaphragm in the eyepiece.

Suppose you are going to measure the distance between two holes in a piece of metal. Lay the piece on the movable stage platform and move it until the center of one hole is directly beneath the cross hair in the eyepiece. Note the micrometer reading. Then turn the micrometer screw to move the object until the other hole is beneath the hair. Make another reading. The difference between it and the first indicates the distance between the holes, in (Continued on page 123)

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USING YOUR MICROSCOPE AS A SHOP TOOL

(Continued from page 122)

thousandths or ten-thousandths of an inch. Recently there has appeared on the market a micrometer, made of cast metal, that retails for twenty-five cents or less. It can be converted into a stage measuring device of fair accuracy, although not as durable or of as great range as a larger and more costly instrument such as machinists use.

A MICROSCOPE with a cross-hair eyepiece can be used as a super-eye for reading scales divided into small fractions of an inch or millimeter. Magnifications of moderate degree, say ten to twenty diameters, are employed. The field should be large enough to enable differences in engraved lines to be seen. The microscope is mounted so that it can be focused on a scale that is attached to the movable part of a machine, or the scale can be fixed and the microscope movable. Thus the microscope might be fastened to a lathe bed and focused on a scale attached to a chuck mounted on the tailstock spindle, to measure the depth of a hole being bored in work held on the faceplate; or the microscope could be mounted on a drill press and focused on a scale attached to the spindle housing, for precision drilling. Another application is to mount the microscope on a lathe carriage and focus it on a scale fastened to the tailstock or other stationary part, for precision turning when there is no calibrated carriage feed on the lathe.

Even the microprojector has invaded the workshop. In hundreds of industrial plants, such instruments are used to check the contours of gear teeth and screw threads, measure the size and shape of small machine parts, and are being used daily to do a thousand and one other things.

Such instruments, called contour projectors, consist of a microscope or projection lens, a source of illumination, a screen, and an object holder. The object to be projected can be mounted between the lamp and the microscope lens, just as a standard slide is placed. A shadow image of it is thrown on the screen, where a chart can be placed to indicate how well the object conforms to standard specifications.

A simple vertical illuminator is provided for use with such instruments for throwing light vertically on the surface of polished gears or other metal parts. This illuminator consists of a sheet of clear glass placed at an angle of forty-five degrees to the surface of the object, and a light source mounted so that it projects a beam against the glass, which in turn reflects it to the object.

THE AMATEUR microscopist can rig up a useful microprojector for throwing images of screw threads, gears, tool edges, saw teeth, and other small objects on a screen where they can be inspected in magnified form. The model maker will find such a device useful for producing miniature parts that are exact scale models of larger parts. The part is drawn, in enlarged form, on a sheet of paper, and used as a pattern to check the shape of a smaller model of the part, whose image is projected on the drawing.

The projector can take a variety of forms. A simple arrangement is to mount a light source, preferably a concentrated-filament lamp such as an automobile headlamp operated by a toy transformer, in such a way that its beam illuminates an object placed on the microscope stage. The lowest power of the microscope usually is sufficient. The beam can be directed against a ground-glass screen supported above the eyepiece, against a sheet of white paper, or against a mirror which reflects it on a sheet of white cardboard or paper.



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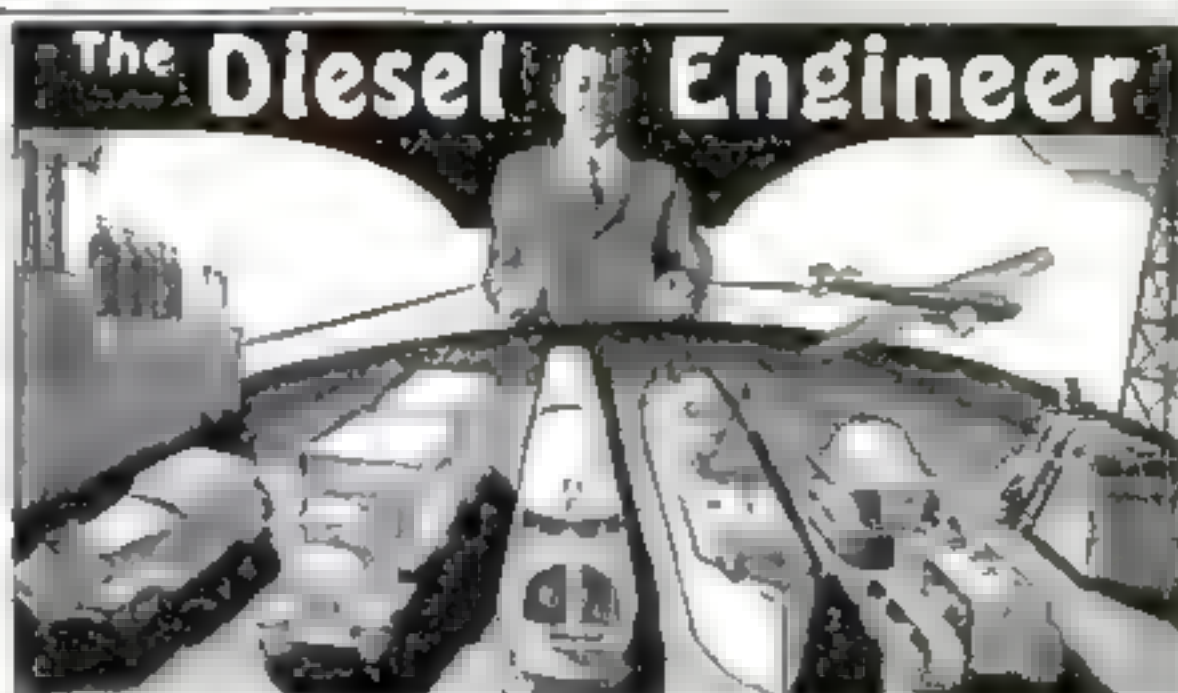
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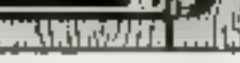
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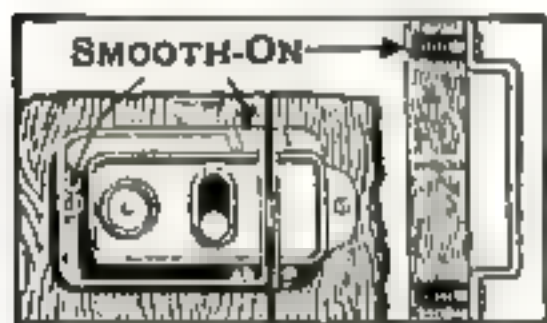
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"Easy," he thought. "We'll train the camera on the ship (Continued on page 125)"

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NO FOOLING IN MODERN MOVIE THRILLERS

(Continued from page 124)

and fly straight down alongside it."

But when he reached Medford he found, not an ordinary airplane, but a streamline monoplane, capable of hurtling downward 400 miles an hour in a power dive. No camera ship could possibly match that speed, and the director went into a huddle with his cameraman to devise some means of filming such action. The solution was surprisingly ingenious. Instead of mounting the camera vertically, he had it laid on its side directly above the cockpit. He took off, and the two planes flew parallel courses sixty feet apart through broken clouds for nearly two hours.

THE director shot about 3,000 feet of film, and later studio cutters took out all the parts in which the monoplane was shown bouncing around in the air. When the film was turned straight up on the screen, the audience saw the ship pointed straight down and screeching through fog and clouds in the prettiest power dive you ever saw.

Such ingenuity cannot be applied to racing automobiles. When a man is flung from an overturning car, you can rest assured he risked his neck, while an extra gray hair or two made its appearance on the director's head.

Once I took fifteen stunt men and racing drivers across the continent from Hollywood to Indianapolis, where we staged a race on the famous speedway. The script called for two particularly dangerous episodes. One driver was to crash through a synthetic concrete wall and turn over; another was to pass the field at high speed directly in front of the grand stand. "Make it real," were my only instructions to the drivers.

Leo Nomis smeared the imitation concrete, cramped his front wheels, and rolled over, escaping with only a few bruises. For the other scene, a young driver, eager to please the director, pressed the throttle to the floor boards, passed the other cars, and swerved sharply, directly in front of the cameras. Three times his car rolled sidewise, and when help reached him he was dead. But audiences thought it was merely a trick.

Several weeks later Nomis reported to a southern California airport to double for Richard Arlen while spinning an airplane 3,000 feet down from broken clouds. Nomis kicked the ship over in a spin and kept her coming directly toward the cameras. He failed to straighten the plane out, and smashed into the earth in full view of the cameras. Once more, audiences thought it must be some kind of trick.

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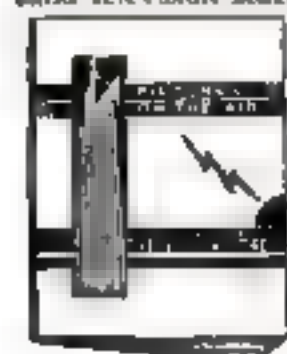
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SCIENCE REMAKES THE DOG

(Continued from page 43)

his task, he knew when to go into action and when to stop, by the tone of his master's whistle.

Among the strangest characteristics cultivated for particular jobs, are those of the Afghan hound, brought to America a few years ago, but used for many centuries as a hunting dog in the mountains of Afghanistan. While he is not so fast as many other hounds on level ground, he has developed high, wide-set hips which fit him especially for running on hills, and for leaping over obstacles. And because he frequently hunted in dense thickets, he has been bred to carry his tail high, like a flag, which his master could see above the concealing brush.

Even more fascinating than the shaping of traits in individual breeds of dogs, has been the creation of new breeds by crossing, for special purposes. Tremendous care was required, to select offspring with just the right inheritances from each stock.

BREEDERS of Chesapeake Bay retrievers, desiring to improve their scent, crossed them with hounds, but were able to preserve the chief characteristics which they had inherited from their other ancestors, supposedly curly-coated retrievers which had been mated with two Newfoundland dogs taken from a wrecked ship. Their stamina and their rough, almost waterproof coats enable them to withstand severe storms and work in water chilled by floating ice.

The Chesapeakes share with American foxhounds and Boston terriers the distinction of being the only breeds originated in the United States. The foxhounds were said to have been developed by George Washington, who, to obtain a faster breed, crossed English foxhounds with French hounds given him by General Lafayette.

Boston terriers represent another success of breeders in obtaining just the desired characteristics from a parent stock, this time the English bulldog. Crossing it with the white English terrier, they obtained the bulldog type of head on a dog smaller and more agile than the bulldog. By that time the bulldog had been cultivated into a good-natured though still courageous animal, and those qualities were preserved.

Strangely, a somewhat similar set of ancestors produced the bull terrier, a very different dog. This time, the breeders wanted a fighter, so they chose the bulldog. They crossed him first with large black-and-tan terriers and white English terriers, producing a heavy-set, short-legged, fawn-colored dog. By careful selection they eliminated the short head and nearly all the other old bulldog qualities except the courage. Then the dog was crossed again with white terriers, and the white color, a recessive characteristic, was fixed, so that the dog became essentially the bull terrier we know today.

THE bulldog himself was the result of careful breeding of dogs for the barbarous sport of bull baiting. The bulls which were to be killed were roped to stakes, so the dog did not require real hunting ability, but only ferocity. The heavy, powerful mastiff was crossed with other breeds, among them probably the pug, for a peculiar reason. The bulldog's chief requirement was to hang on, when he caught hold, and the pug's short nose enabled him to breathe without letting go.

With the passing of bull baiting, the bulldog began to be cultivated with two oddly contrasting aims. The ferocity was bred out, until he became a really kindly beast, but at the same time, his ugliness of appearance was encouraged to such an exaggerated extent that it often interfered with his health. Breathing frequently was an effort for him,

even in repose; and his lower jaw protruded so far that he often had trouble chewing his food, making him a prize example of unwisely directed heredity.

Like the bulldog, the Airedale terrier had his origin in a questionable pursuit. Not only was he for a considerable time a mongrel, but he served as the helper of poachers on forbidden game preserves. The poachers worked at night, and wanted dark-colored dogs which would not be conspicuous, and which hunted without baying. They crossed old English terriers and otter hounds first, then Irish terriers and bull terriers, until finally the present type was evolved and stabilized.

CHANGES in the occupations of other dogs, as strange as the reformation of the Airedale and bulldog, have been effected by skillful crossing. The pointer, today's widely used bird dog, was employed 300 years ago in England for finding rabbits to be chased by greyhounds, which hunt by sight.

Breeders crossed the English pointer with Spanish dogs, to get the superior "pointing" ability of the latter, but they bred out the foreign dog's other characteristics, as inferior to the native's. The original pointer stock is believed to have descended from "setting spaniels," greyhounds, foxhounds, and bloodhounds. Later, to produce a kinder disposition, the dogs were crossed with setters.

The English setter's ancestry, quite curiously, includes the Spanish pointer, along with several types of spaniels. The setter himself had started work as a hunting dog long before the advent of firearms; he located birds and crouched while nets were drawn over them.

The English sportsmen's desire for a dog to chase the fox out of his hole, resulted in the mingling of an amazing array of dog-talent, to produce the popular smooth-coated fox-terrier. Many experts believe the little animal carries the blood of black-and-tan terriers, beagles, greyhounds and bull terriers, with important heritages in alertness, scent, speed, or courage from each.

Another little dog, descended from different stock, became the wire-haired fox terrier. It was crossed with the smooth terrier, to get symmetry and white coloring, but the breeders were careful to retain the rough coat.

Almost as frequently as new breeds have been created, old ones have disappeared or suffered serious declines. The Irish wolfhound, one of the most famous breeds in history and perhaps the largest, degenerated and almost became extinct with the passing of conditions which had made it useful. But an English sportsman, wishing to restore it, crossed the remaining dogs with deerhounds, which he thought were of the same breed. Then he crossed them with Great Danes and Russian wolfhounds, until once again the Irish wolfhound became the tallest known dog, standing as high as thirty-six inches at the shoulder.

MANY other dogs which have become extinct, or almost so, are represented by new breeds in the making of which they had a part. The black-and-tan, or "rat terrier," for example, whose unreliable temper cost him many friends, still flourishes today in a transformed and reformed state, as a part of the Boston, the bull terrier, the fox terrier, the striking and intelligent Doberman Pinscher (first bred by a German dog catcher) and in many other popular breeds.

Changing tastes and living conditions which so often decree the end of a dog as a type, frequently make a new place for a part of him—and it is the job of the skillful breeder to see that the right part is saved.

FOOD OR POISON?

(Continued from page 25)

asked Thomas A. Edison for a definition of electricity. He replied that any schoolboy could give as good a definition as he could. He knew what electricity *does* but not what it *is*. So with allergy. We know its effects, but much concerning how the effects are produced is shrouded in mystery. Two national groups, the Association for the Study of Allergy and the Society for the Study of Asthma and Allied Conditions, are now seeking to penetrate these mysteries.

ONE widely accepted theory is that the reaction is caused by foreign substances reaching the blood stream. The patient's system has built up a standing army of tiny bodies in the blood to fight this particular substance. When more of it is introduced, many specialists believe, these bodies go in to action so quickly that the health of the patient is upset.

This theory that the reaction takes place in the blood stream would explain an occurrence in an eastern hospital that reads, at first glance, like a page from some Baron Munchausen of medicine.

In an emergency, a patient received a blood transfusion that saved his life. But, shortly afterwards, he began to sneeze repeatedly. Investigation showed that the donor of the blood was allergic to chicken feathers and that the allergy had been transferred temporarily to the patient, who was immediately affected by the feathers in his pillow!

Another curious instance of temporary allergy was reported recently to the American Medical Association. After an abdominal operation, a woman developed symptoms of hay fever. Her physician discovered that she was allergic to the catgut used in sewing up the incision. It had been treated to last forty days. At the end of that time, when the catgut had been absorbed by the body, the "hay fever" disappeared.

Occasionally, some common drug, such as quinine or aspirin, will produce an unexpected result because the patient is allergic to it. One man, in the South, who was dying of diabetes, could not take insulin. A girl who had an infected hand made matters worse by putting on a flaxseed poultice. She was allergic to flaxseed.

Cosmetics—face powders, lip sticks, perfumes, hair lotions, soaps,—often act as poisons to sensitive persons. I remember one case in which a wealthy woman traveled thousands of miles,—to California, Florida, Africa,—in search of a climate that would relieve her asthma. Then, she found she was carrying her asthma wherever she went,—in her powder compact. She was allergic to orris root, one of the ingredients in the powder she used.

That recalls one of the funniest cases I ever encountered. A young man found that whenever he kissed his sweetheart he began to wheeze and snifle. A special brand of face powder was the explanation.

AGAIN, there is the record of a sea captain who had an attack of asthma whenever he came into port but who was free from the disorder at sea. Investigation showed that he was sensitive to orris root in face powder. At sea, where there were no women and no face powder, his asthma disappeared.

To aid thousands of persons who are allergic to orris root, a Chicago manufacturer has put on the market a powder free from the troublesome substance. This same company is turning out a complete line of non-allergic cosmetics which are sold from coast to coast.

Other concerns are catering to the trade of those sensitive to various foods and dusts. A milk substitute (Continued on page 129)

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TESTS WITH CHLORINE AND ITS COMPOUNDS

(Continued from page 55)

generated in small quantities in an extremely simple piece of apparatus consisting of a wide-mouthed bottle, a medicine dropper, a two-hole cork, a test tube, and a short section of glass tubing. Crystals of potassium permanganate are placed in the bottle and the medicine dropper is filled with hydrochloric acid. When a small amount of chlorine is required, squeezing the bulb will squirt a few drops of the acid on the potassium permanganate and the chlorine generated will flow out through the tube. Substances to be tested with the chlorine should be placed in a small test tube which can be pushed over the outlet tube. As in the previous experiments, the test tube should be heated gently to hasten the reaction.

CHLORIDES also can be made in the home laboratory directly from hydrochloric acid by allowing the acid to come in contact with the desired chemical. For example, cuprous (copper) chloride can be made by dissolving copper in hydrochloric acid, iron chloride can be produced with iron and the acid, and magnesium chloride can be obtained by combining magnesium hydroxide (milk of magnesia) and hydrochloric acid. In these experiments, the acid should be heated slightly.

The chlorides formed by these and other reactions can be obtained in the dry form by evaporating the solution after the reaction is complete. Simply apply heat to concentrate the liquid and then allow it to crystallize. Or, if you prefer, continue to heat it gently until only a dry powder remains.

When solutions being evaporated are heated from underneath in the usual way, you will find that they have a tendency to spatter. A better and safer method is to apply the heat from above. If a Bunsen burner is used, pass the flame back and forth over the top of the liquid. If your laboratory is equipped with electricity, the homemade overhead heater described and illustrated on page 55 will do the job with a minimum of fuss and bother.

RUBBER WATERPROOFED BY NEW PROCESS

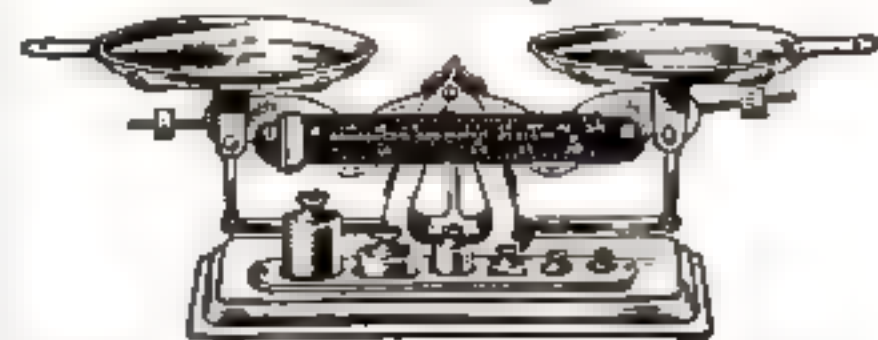
RUBBER is not waterproof. Contrary to popular opinion, it disintegrates into a soft, mushy substance when exposed to moisture for long periods. Recent experiments conducted by two Boston, Mass., chemists have resulted in the discovery of a method of waterproofing rubber so that it can be used as an insulating material for ocean cables and underground power lines, which are now sheltered in gutta-percha or lead. According to the report of the tests, the protein materials present in commercial rubber not only absorb water but also provide paths by which moisture can permeate the rubber. Removal of these proteins, it is said, makes rubber completely waterproof. None of its characteristic properties are lost in the de-proteinizing process, it is claimed, and the waterproofed rubber is expected to be useful in all cases where insulating materials must withstand the effects of long exposure to moisture and dampness.

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FOOD OR POISON?

(Continued from page 127)

made from soy beans which can be digested by patients who are upset by ordinary milk is now on the market and a process recently patented by an Ohio inventor will make it possible for allergic people to drink cows' milk without ill effects. Special heating chambers remove the objectionable elements. Incidentally, it is rarely the milk itself that causes trouble. Rather it is the traces of something the cow has eaten, such as bran, weeds, or various flowers.

In Massachusetts, a large furniture factory is doing a flourishing business supplying special chairs, beds, and sofas to buyers who are allergic to feathers and animal hairs. Large department stores throughout the United States are also selling specially designed covers that slip on over chairs and sofas to prevent dust from the interior from reaching the air.

OF COURSE, the commonest form of allergy due to floating particles is hay fever. Hundreds of thousands of people travel millions of miles a year to escape the air-borne pollen which causes them misery.

That it is not necessary even to swallow or breathe a substance to have it upset you is illustrated by a host of curious cases in the records of allergy. Here are two with a humorous twist.

A New York woman went to an oculist to be fitted with new glasses. On her way home, she noticed that people were turning and staring at her as they went by. When she glanced in the mirror, she understood the reason. Across each cheek was a huge, cherry-red welt. The composition used in the frames of the spectacles evidently contained some element to which her system was allergic.

Imagine the amazement of another eastern woman when her upper lip began to swell as soon as she started playing the flute in an orchestra of which she was a member! By the end of the concert, it was puffed up as though a bee had stung it. That night, the swelling went down. But the next day, when she started to practice, it puffed up again. Every time she put the flute to her mouth, her upper lip began to swell!

She took the instrument and her weird story to her family physician. He made tests and learned that a new mouthpiece recently placed on the flute was made of wood to which the woman was highly sensitive. When another mouthpiece replaced it, her mystifying disorder was ended.

In conclusion, here is the question which is most commonly asked me about allergy. Is it inherited? If your father is upset by milk or eggs or primrose pollen, does that mean you will be too?

SCIENCE can give a definite answer. It is: No. After studying the family histories of 150 allergic children and 315 normal ones, Dr. Bret Ratner, professor of children's diseases at New York University College of Medicine, recently reported that he found no more allergic parents in the first group than in the second.

However, it is known that a tendency to be sensitive to something often is handed down from father to son. For example, I know a man who can ride horseback all day long, while his son begins to sneeze if he comes within half a block of a horse. But, the same son can eat walnuts whenever he wants while the slightest taste makes his father break out with hives!

In this strange world of idiosyncrasies, laws of which we know little are constantly at work. And, in their functioning, they produce some of the most fascinating, as well as bewildering, pages in the story of medicine.

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KEEP YOUR CAR LOOKING NEW

(Continued from page 60)

rest of the car. The right front fenders of my last two cars have gone dull and shabby, while the rest of the car stayed all right. Can anybody account for that?"

Gus winked slyly at Joe. "Here's where I get a reputation as a magician," he whispered. "You bought a new house four years ago, didn't you, mister?" he challenged.

"I did, but how in the world did you know that?" The man with fender-finish trouble countered in amazement.

"And you've got a one-car garage," Gus went on, "that faces south directly on a street, with a window on the east side."

"Can you beat that!" the tourist gasped. "That's exactly what I have got. Are you a mind reader or something?"

A BROAD smile crept over Gus's rugged features as the eyes of every one in the circle centered on him. "No hocus-pocus like that, just a matter of cause and effect," he explained. "You said your last two cars had bum fender finish. You're the kind of chap that gets a new car about every second year so it was pretty safe to estimate that the trouble started four years ago."

"Now, the only thing that is likely to cause that kind of trouble is unequal exposure to sunlight. That meant that four years ago you began to keep your car in a new place, and the average man doesn't change garages without changing houses too. Of course, I was only guessing when I described your garage, but if you'll stop to think a bit you'll see that's about the simplest combination that'll let sunlight work on your right front fender for several hours every day. If the garage didn't face right on the street you might have to turn the car and back in but if you did that, it'd be the left rear fender that would be affected."

"Pretty slick reasoning all the same," the car owner agreed admiringly, amid several expressions of approval from the others.

"I never realized sunlight could do that much damage," he added. "First thing I'll do when I get home is board up that window or put a shutter on it. I don't need that light, anyway."

"Sunlight is the worst enemy you've got when you try to keep a car looking like new," Gus went on, while every man in the circle listened closely. "Whether it's enamel or lacquer, the sunlight not only fades the color in time, but it also seems to hasten the surface corrosion, or whatever it is that spoils the shine. It takes the life out of rubber, and does things to the upholstery, too. That's why winter is actually easier on a car's finish than summer—the sun doesn't shine so brightly. Of course, you can't keep the sun from shining on your car while you're using it, but it certainly pays to fix your garage so that no direct sunlight can reach it while you're not using it. Another thing you can do is to park your car in the shade when you are going to leave it standing for any length of time."

"HUMPH!" grunted the tourist who had started the argument. "In my town, it's a heck of a job to find a place to park at all. You have to take what you can get, shade or no shade."

"I guess most places are like that, now," Gus smiled, "but it won't do any harm to keep the idea in mind, anyhow."

"Lot's of things are bad for a car's finish beside sunlight," the little man suggested.

"Sure, they are," Gus agreed. "A strong wind is one of them, especially if it contains a lot of dust. Works on the same principle as a sand blast. Small stones and grit flung up by the tires of the car in front of you can cut right through the (Continued on page 131)



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KEEP YOUR CAR
LOOKING NEW
(Continued from page 130)

paint job and let moisture get through to start a rust spot. The mud in some localities is strongly alkaline, and no paint or lacquer is immune to the effect of alkali.

"Road tar itself usually won't harm the finish," Gus continued, "but scraping it off the underside of fenders has spoiled the looks of lots of cars—especially in sections near the sea, because the salt spray attacks the bare metal underneath, and pretty soon there's a hole right up through the fender. When you're up against that proposition, the best thing to do is to leave the tar there."

"Maybe that fellow that greased his whole car wasn't so dumb after all," piped up the little chap again. "None of those things would have much effect on a grease coating."

"**H**E HAD the right idea, but it was a mighty unsightly way to carry it out," Gus commented. "The sensible version of that would be to give the car a proper waxing."

"A thin coat of wax," Gus went on, "does have some value in cutting down the effect of sunlight, but the coating is too thin to exclude it entirely. It has a lot more effect in cutting down surface oxidation and in warding off the scrubbing effect of dust-blown particles. The grit slides, instead of cutting it. And wax keeps moisture and dirt from sticking so tightly to the enamel or lacquer."

"What do you mean by 'proper' waxing?" asked another of the tourists.

"Well, in the first place," Gus told him, "the car ought to be absolutely clean before you start. That means a good wash with soap and water. If the finish is dull, that's the time to use one of the polishes or cleaners that leaves a high, dry shine. Waxing is just a matter of applied 'elbow grease.' You rub on a coating of the wax, and then polish off the excess so that what's left forms a thin, protective layer."

"Now here's where a lot of fellows go wrong," Gus warned. "Don't let anybody tell you that you can wipe off dried dirt from a wax-coated finish with a dry rag without having a bad effect."

"If there is dried mud on the car, or if you have been caught in a shower with a lot of dust on the car and it has dried to a speckled finish, wet down the car with a hose. Then you can wipe the dirt and water off quickly and easily without using any soap at all."

"But doesn't the mud stick just as tight on a waxed car if you let it dry on and stay there several days?" one of the tourists asked.

"If the car has been properly waxed," Gus replied, "it never sticks so tight but that it will come off just by a thorough wetting and a gentle wiping. But why let it dry on? A much better plan is to keep a couple of old, ragged bath towels in your garage, and, when you come in after a run in the rain, get busy right away and wipe off the whole car."

"**B**UT what I want to know is when you should get busy and wax the car again. Every month, or every two months?" the little man asked.

"There's no definite time limit," Gus explained. "When a car has wax enough on it, the rain never really wets it at all. The drops just roll around till they come together, and then run off. The minute you begin to notice that the water is forming a smooth, shiny layer on the surface of the finish, which indicates that it is really wetting it, then it's time to re wax."

"Well," Gus grunted, indulging in a cavernous yawn, "guess I'll hit the hay. How about it, Joe?"

"Speaking of other people's auto troubles—" Joe grinned provocatively.

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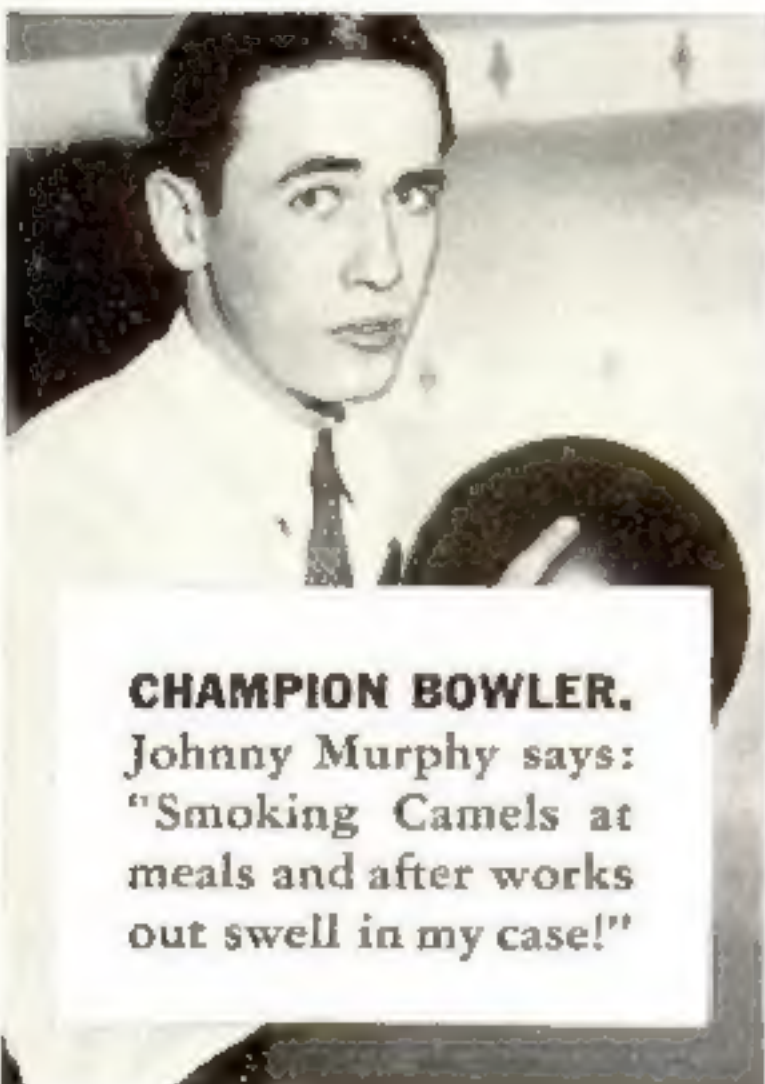
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